

ALTERNATIVE PROPOSALS FOR THE
EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION
FONT FOR 7 x 9 MATRIX PRINTERS

June 1972

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ALTERNATIVE PROPOSALS FOR THE
EUROPEAN COMPUTER MANUFACTURERS ASSOCIATION
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June 1972

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INTRODUCTION

This report illustrates alternative proposals made as a result of a study of the ECMA Font for 7x9 matrix printers, first draft, March 1972, (ECMA TC4 72/15).

The font is intended to provide maximum legibility compatible with OCR (machine reading) applications.

The dimensions between the lines of the design grid are, horizontally, 0,181 mm and vertically 0,385 mm. The dot diameter is 0,4 mm $\pm$ 0,1 mm. The font contains 10 numerals, 26 upper case letters 7 national letters and 29 other symbols.

The alternative proposals have been made after comparative analysis of legibility and human acceptance and computer analysis of suitability for OCR application.

The guiding criterion used in evaluation and in the design of the alternative proposals to ensure maximum legibility and human acceptance has been to imbue the figures with a high degree of what R.S. Easterby calls "Figural goodness". He defines "figural goodness" as a measure of the enhancement of the perceptual process of decoding visual stimuli; gestalt perception theory prescribes that the apprehension of meaning from a given symbol can be facilitated by the shape of the symbol. Those qualities contributing to "figural goodness" include simplicity, unity and lack of apparently superimposed forms. In particular it was felt that the shape of each letter should be as near as possible to that in common use (and, of course, to ECMA OCR Font B.). That the continuity of line in a symbol is more important than the density of points in that line. That closed spaces should be kept as large as possible and that the symmetric or asymmetric quality of a symbol should be emphasised as far as is compatible with the design of a font with an organic unity of form and weight.

Attention has been paid not only to the single letter but also to the relationship of one letter to another. The position of certain symbols in the matrix has been changed to improve spacing.

The computer analysis has been made using a programme which permits the comparison of any two patterns in the 7x9 matrix (vertical and horizontal) and the comparison of any pattern with all the others. The comparisons were made not only in the complete overlap position but also in 63 other positions obtained by moving one pattern with respect to the other ± 4 steps in the horizontal and ± 3 steps in the vertical plane.

The output of the programme is composed of a table which contains the results of all the comparisons which are below the threshold of 3 dots, indicating for every result the matrix compared and the number of dots of difference plus the reticular position to which the result corresponds.

The value of the threshold has been chosen to represent an acceptable minimum in this first stage of font assessment (7.3., ECMA TC4/72/1) based on nominal grid and dot dimensions.

The patterns which have been compared are:

- The ECMA proposal as shown in the document TC4 72/15.*
- Alternatives to the ECMA proposal suggested by improved “figural goodness” and by the necessity to optimize the differences for OCR applications.*

The analysis of the results shows that in almost all cases a minimum difference of at least 3 dots has been achieved with the following exceptions:

<i>; – L.V.M. = 2/8</i>	<i>; – : = 1/8</i>
<i>1 – L.V.M. = 2/14</i>	<i>. – , = 1/4</i>
<i>! – L.V.M. = 2/0</i>	<i>U – Ü = 2/4</i>
<i>! – , = 2/4</i>	<i>M – N = 2/32</i>
<i>! – ' = 2/4</i>	<i>D – 0 = 2/14</i>

Of these results it seems important to emphasize the critical pairs M-N, D-0 which could perhaps require further study, even though an increase in dot difference does not seem easy to achieve without large changes in the form of the letters themselves.

SOLO UNA
COLONNA
AL NATURALE

ECMA
PROPOSAL

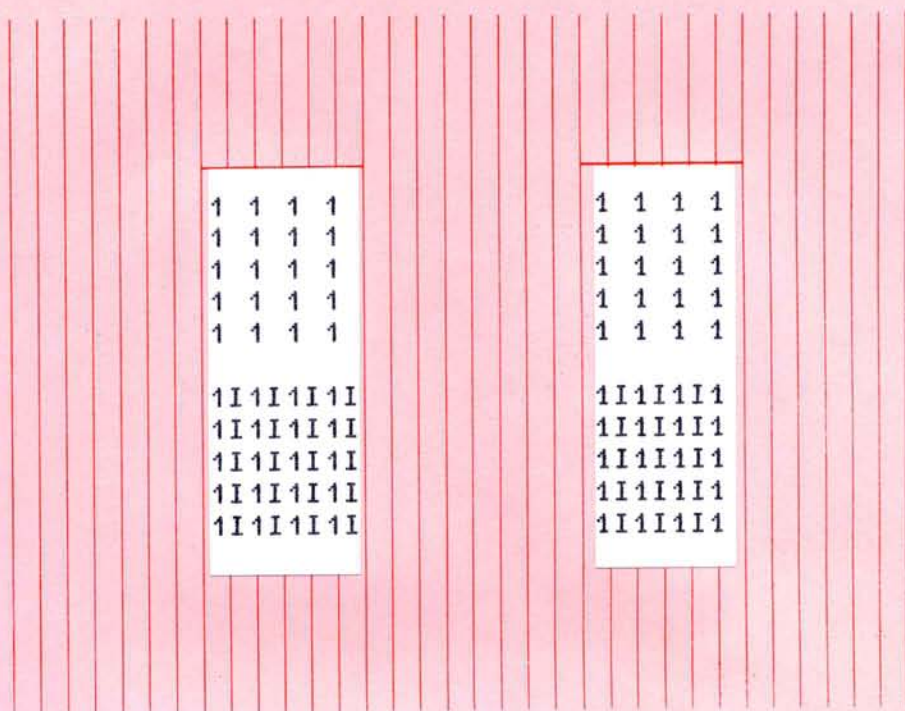
NO

1	1	1	1
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4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9
0	0	0	0

A	A	A	A
B	B	B	B
C	C	C	C
D	D	D	D
E	E	E	E
F	F	F	F
G	G	G	G
H	H	H	H
I	I	I	I
J	J	J	J
K	K	K	K
L	L	L	L
M	M	M	M
N	N	N	N
O	O	O	O
P	P	P	P
Q	Q	Q	Q
R	R	R	R
S	S	S	S
T	T	T	T
U	U	U	U
V	V	V	V
W	W	W	W
X	X	X	X
Y	Y	Y	Y
Z	Z	Z	Z

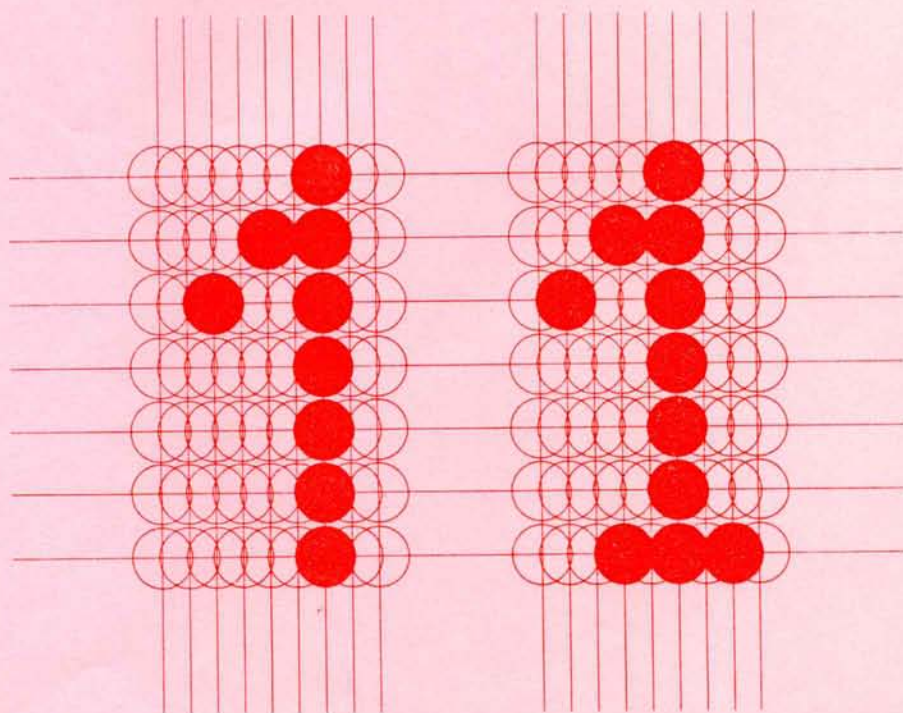
À	À	À	À
Ä	Ä	Ä	Ä
Æ	Æ	Æ	Æ
Ï	Ï	Ï	Ï
Ö	Ö	Ö	Ö
Ø	Ø	Ø	Ø
Ü	Ü	Ü	Ü

*	*	*	*
+	+	+	+
=	=	=	=
/	/	/	/
.	.	.	.
,	,	,	,
:	:	:	:
;	;	;	;
"	"	"	"
'	'	'	'
?	?	?	?
!	!	!	!
(	(	(	(
)	)	)	)
<	<	<	<
>	>	>	>
[	[	[	[
]	]	]	]
%	%	%	%
#	#	#	#
&	&	&	&
@	@	@	@
^	^	^	^
~	~	~	~
£	£	£	£
\$	\$	\$	\$
\	\	\	\



ECMA proposal 1 — L.V.M. = 1/14. Alternative proposal = 2/14.
 To obtain the increased OCR readability the risk of possible
 confusion in human recognition between 1 and I has been accepted.

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**ECMA
PROPOSAL**

**ALTERNATIVE
PROPOSAL**

2 2 2 2
2 2 2 2
2 2 2 2
2 2 2 2
2 2 2 2

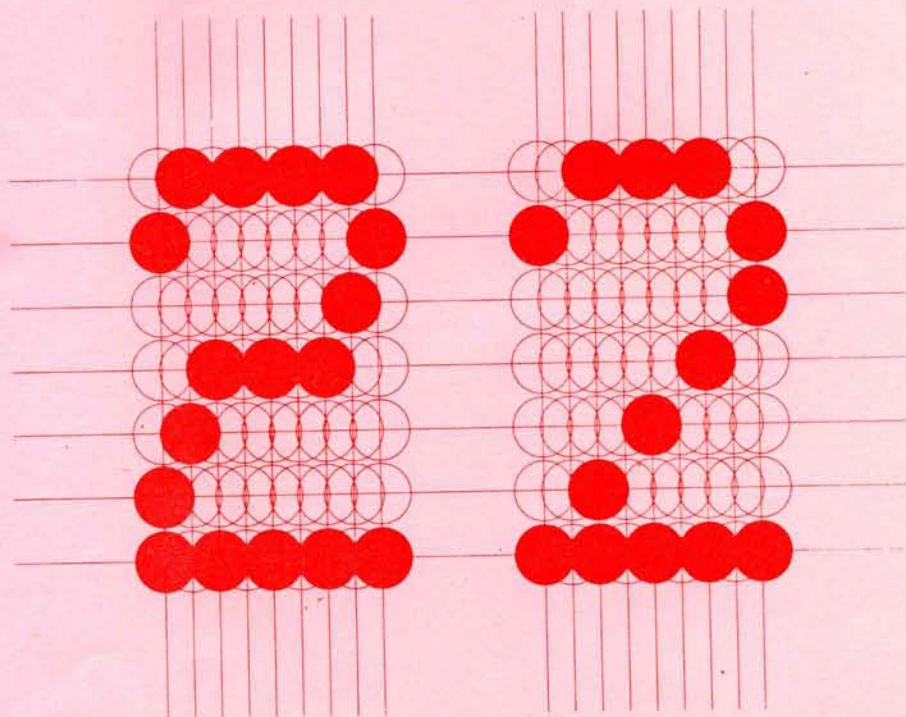
21212121
21212121
21212121
21212121
21212121

2 2 2 2
2 2 2 2
2 2 2 2
2 2 2 2
2 2 2 2

21212121
21212121
21212121
21212121
21212121

Both solutions acceptable for OCR applications.
Increased "figural goodness", qualities of symbol emphasised.

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ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL

3	3	3	3
3	3	3	3
3	3	3	3
3	3	3	3
3	3	3	3

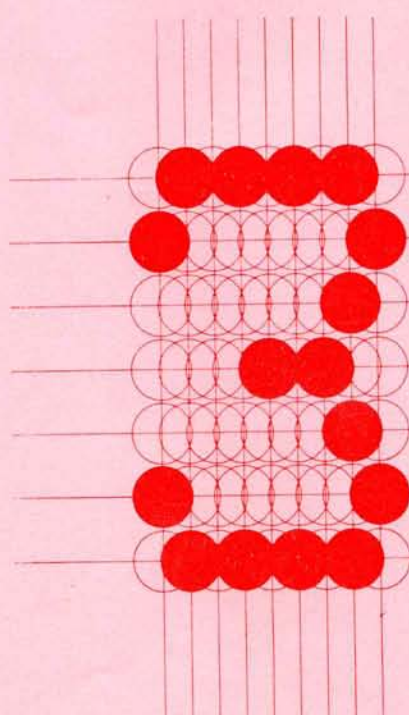
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3	8	3	8	3	8	3	8
3	8	3	8	3	8	3	8
3	8	3	8	3	8	3	8
3	8	3	8	3	8	3	8

3	3	3	3
3	3	3	3
3	3	3	3
3	3	3	3
3	3	3	3

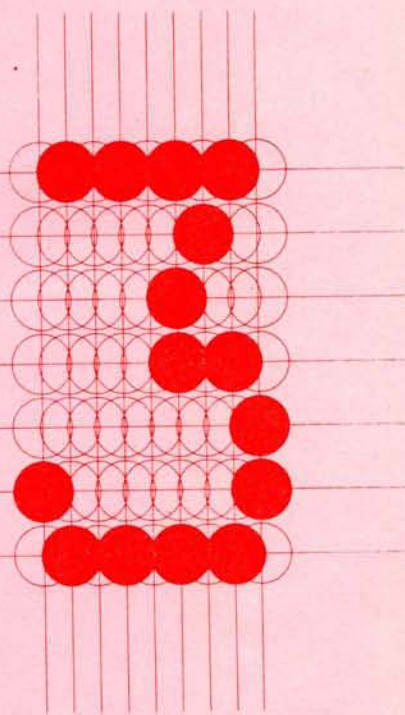
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8	3	8	3	8	3	8	3
8	3	8	3	8	3	8	3
8	3	8	3	8	3	8	3
8	3	8	3	8	3	8	3

Both solutions acceptable for OCR applications.
Increased "figural goodness", qualities of symbol emphasized.

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ECMA
PROPOSAL



ALTERNATIVE
PROPOSAL

7	7	7	7
7	7	7	7
7	7	7	7
7	7	7	7
7	7	7	7

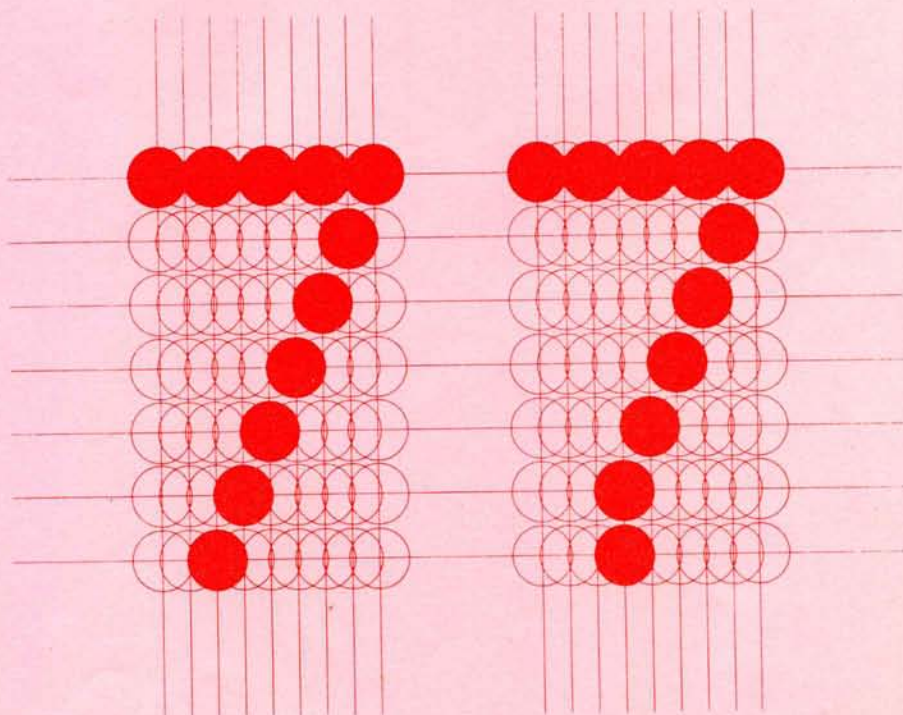
7	2	7	2	7	2	7	2
7	2	7	2	7	2	7	2
7	2	7	2	7	2	7	2
7	2	7	2	7	2	7	2
7	2	7	2	7	2	7	2

7	7	7	7
7	7	7	7
7	7	7	7
7	7	7	7
7	7	7	7

7	2	7	2	7	2	7	2
7	2	7	2	7	2	7	2
7	2	7	2	7	2	7	2
7	2	7	2	7	2	7	2
7	2	7	2	7	2	7	2

ECMA proposal 7-Z = 2/14. Alternative proposal = 3/4.
 ECMA proposal 7-T ≥ 4/0. Alternative proposal ≥ 4/0.
 Increased "figural goodness", more similar to commonly accepted symbol.

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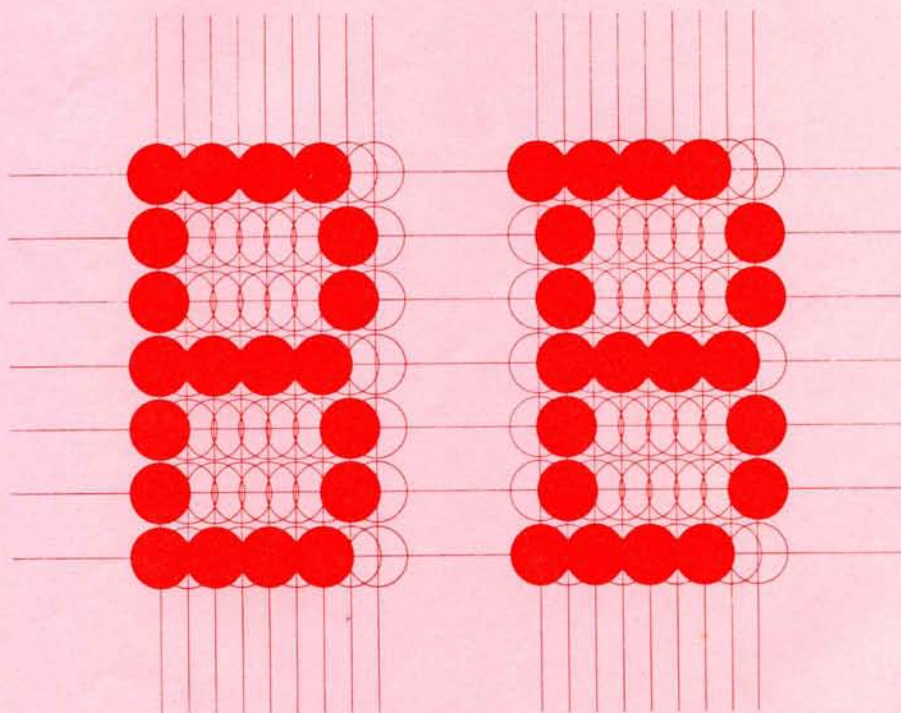
ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL

B	B	B	B
B	B	B	B
B	B	B	B
B	B	B	B
B	B	B	B
B B B B B B B B			
B B B B B B B B			
B B B B B B B B			
B B B B B B B B			
B B B B B B B B			

B	B	B	B
B	B	B	B
B	B	B	B
B	B	B	B
B	B	B	B
B B B B B B B B			
B B B B B B B B			
B B B B B B B B			
B B B B B B B B			
B B B B B B B B			

ECMA proposal B-8 = 2/10. Alternative proposal = 3/10.
 ECMA proposal B-D = 2/10. Alternative proposal = 3/18.
 ECMA proposal B-S = 2/6. Alternative proposal $\geq$ 4/0.
 ECMA proposal B-Q = 2/16. Alternative proposal $\geq$ 4/0.
 Increased "figural goodness", added serifs.



ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL

C	C	C	C
C	C	C	C
C	C	C	C
C	C	C	C
C	C	C	C

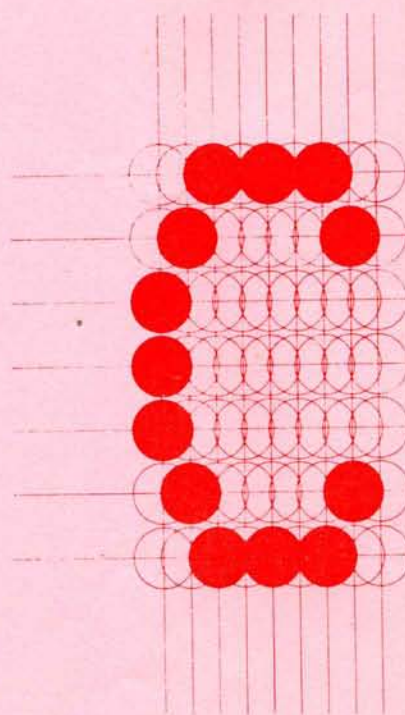
C	M	C	M	C	M	C	M
C	M	C	M	C	M	C	M
C	M	C	M	C	M	C	M
C	M	C	M	C	M	C	M
C	M	C	M	C	M	C	M

C	C	C	C
C	C	C	C
C	C	C	C
C	C	C	C
C	C	C	C

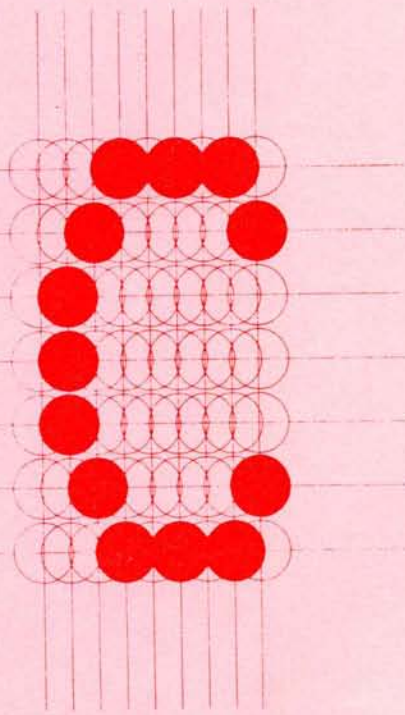
C	M	C	M	C	M	C	M
C	M	C	M	C	M	C	M
C	M	C	M	C	M	C	M
C	M	C	M	C	M	C	M
C	M	C	M	C	M	C	M

Both solutions acceptable for OCR applications.
 The ECMA solution has been moved a 1/2 dot to the right to
 improve spacing.

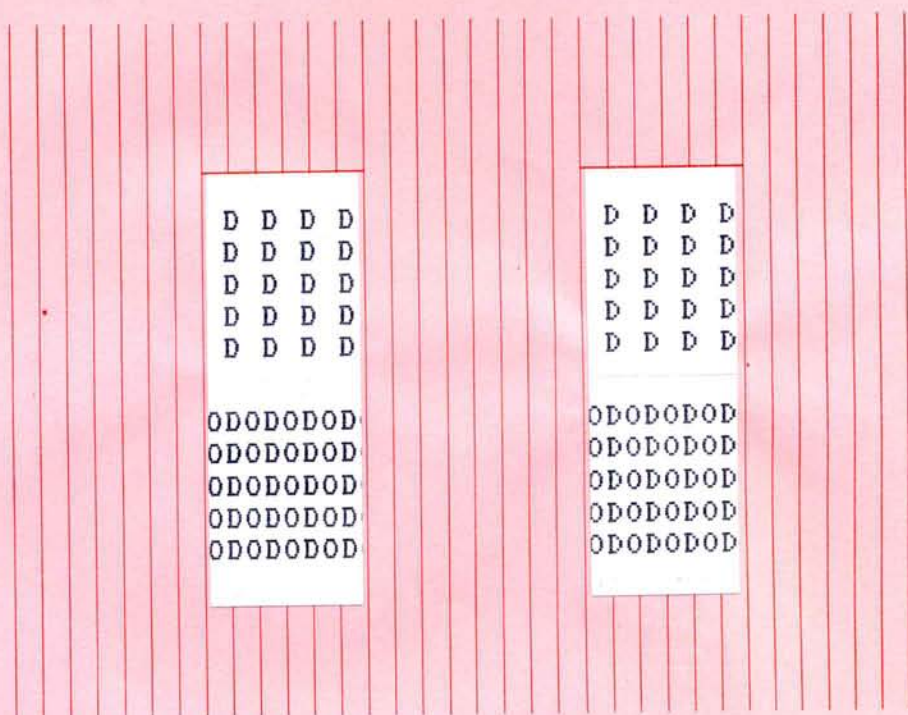
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ECMA
PROPOSAL



ALTERNATIVE
PROPOSAL



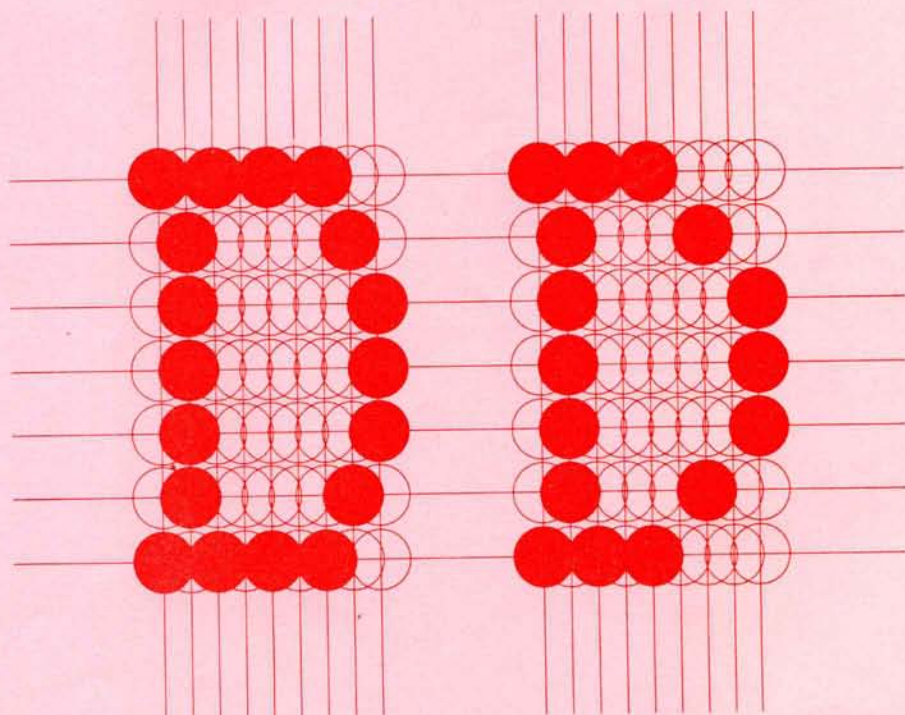
ECMA proposal D-Zero = 0/18. Alternative proposal $\geq 4/0$.

ECMA proposal D-8 $\geq 4/0$. Alternative proposal $\geq 4/0$.

ECMA proposal D-B = 2/10. Alternative proposal = 3/22.

ECMA proposal D-O = 2/6. Alternative proposal = 2/14.

The alternative solution is acceptable as far as human legibility is concerned (critical pairs D-O and D-Zero). Increased "figural goodness" and font unity.



ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL

F F F F
F F F F
F F F F
F F F F
F F F F

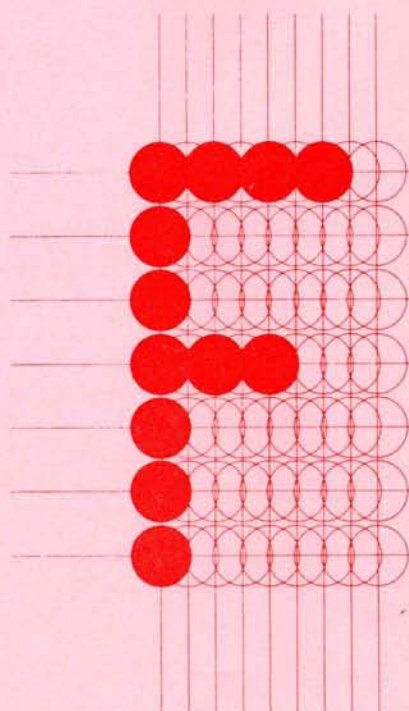
FEFEFEFE
FEFEFEFE
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FEFEFEFE
FEFEFEFE

F F F F
F F F F
F F F F
F F F F
F F F F

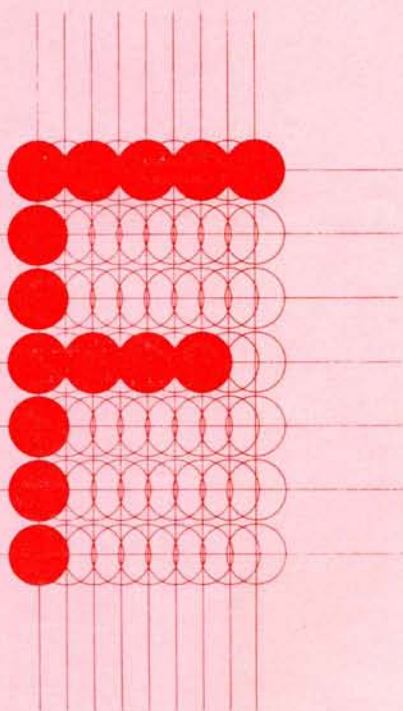
FEFEFEFE
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FEFEFEFE
FEFEFEFE
FEFEFEFE

ECMA proposal F-T = 2/14. Alternative proposal $\geq 4/0$.
Increased legibility with larger dimensions.

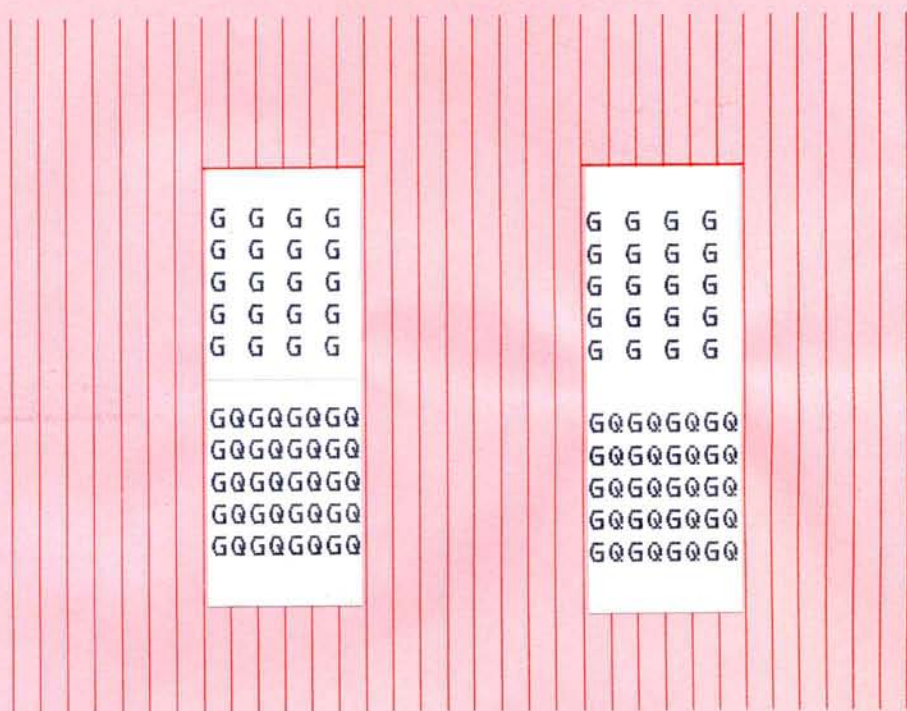
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ECMA
PROPOSAL

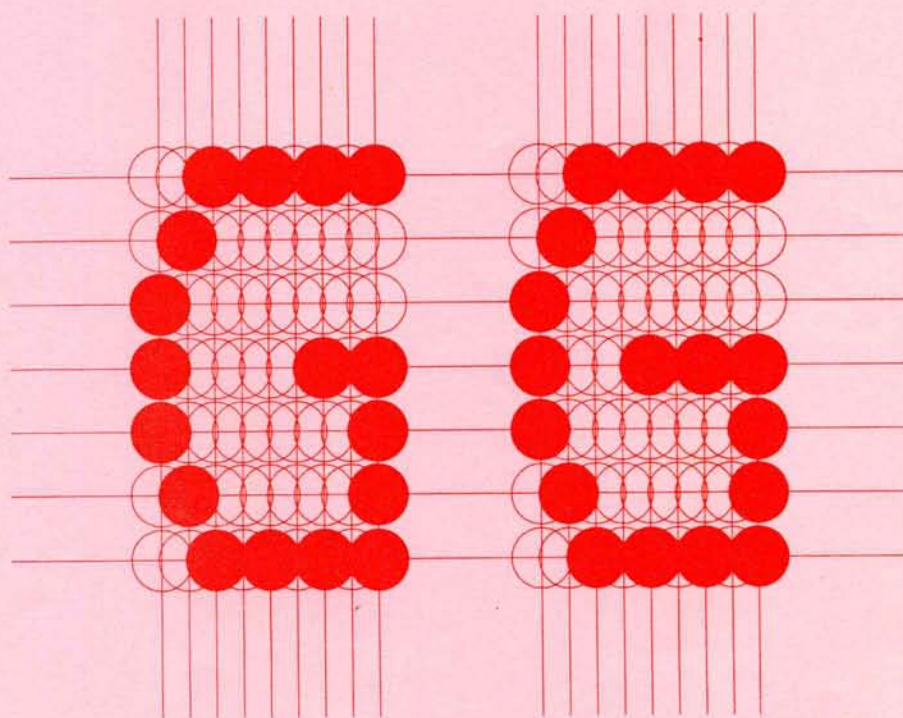


ALTERNATIVE
PROPOSAL



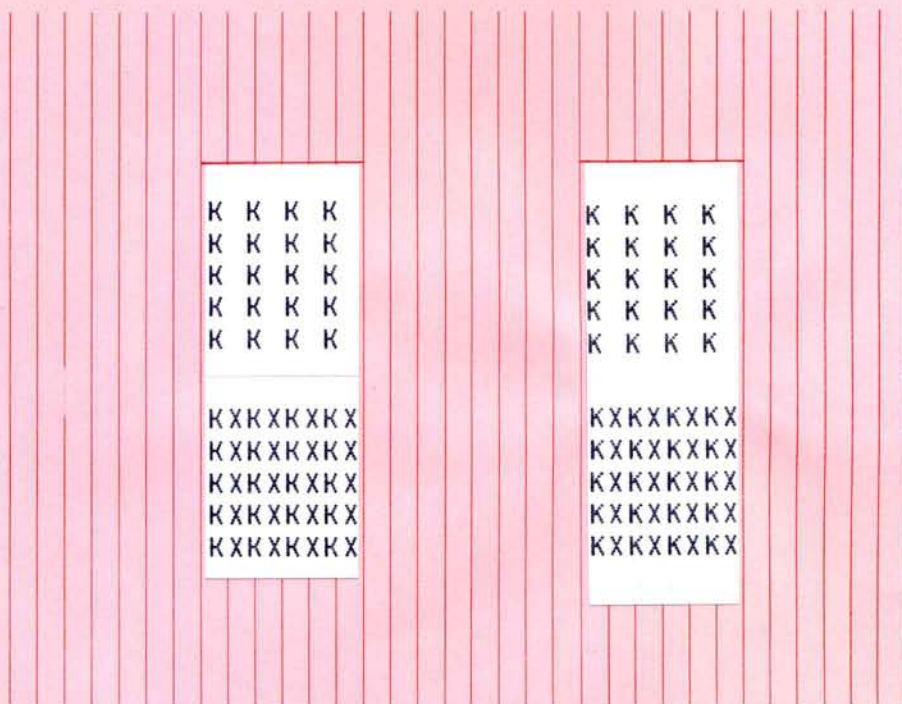
ECMA proposal G-Q = 2/18. Alternative proposal $\geq 4/0$.
 Increased legibility with reinforced horizontal stroke.

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ECMA
 PROPOSAL

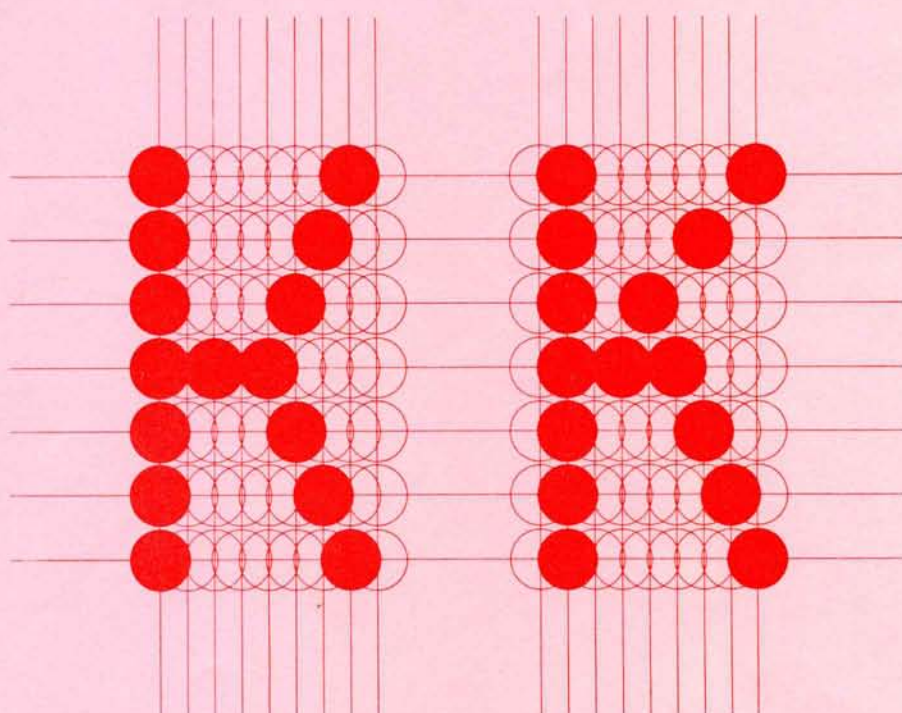
ALTERNATIVE
 PROPOSAL



Both solutions acceptable for OCR applications.

Increased "figural goodness", more similar to commonly accepted symbol.

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OLIVETTI



ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL

0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

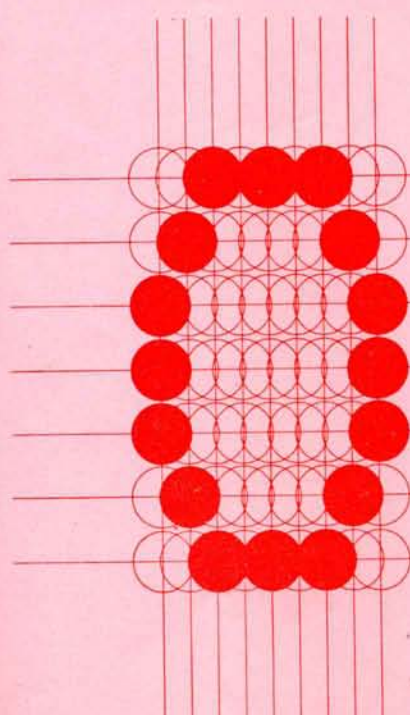
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0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

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0	0	0	0
0	0	0	0
0	0	0	0
0	0	0	0

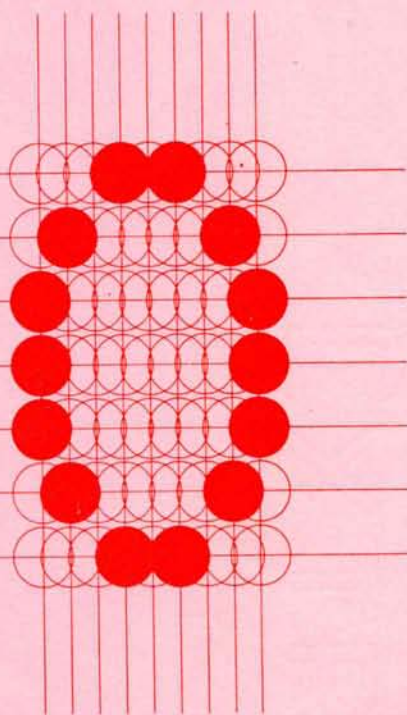
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0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0

ECMA proposal O-Zero = 0/12. Alternative proposal $\geq 4/0$.
 ECMA proposal O-Q = 2/24. Alternative proposal = 3/2.

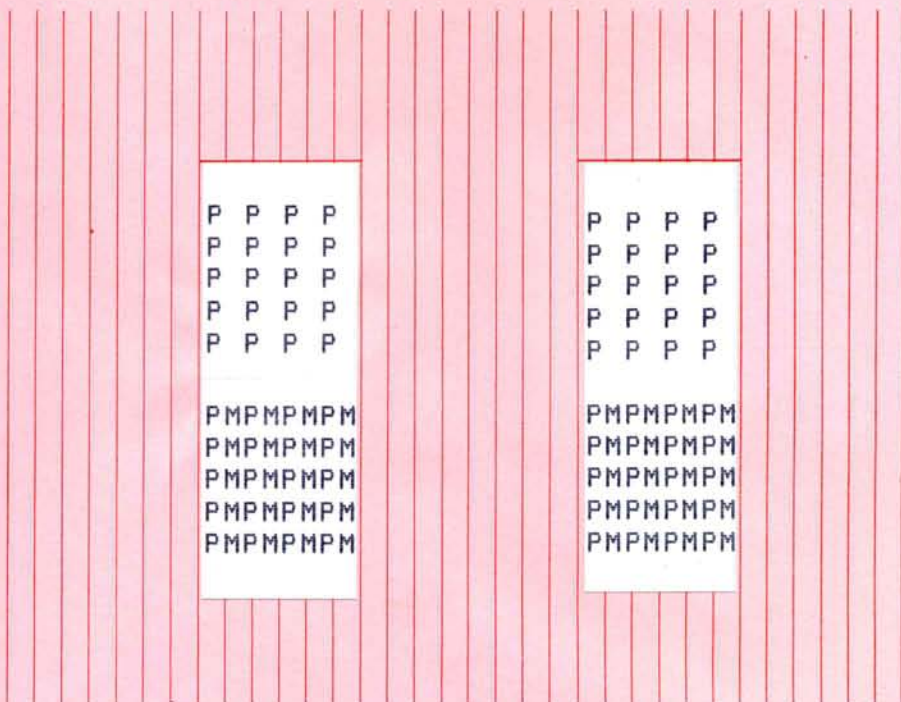
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ECMA
PROPOSAL



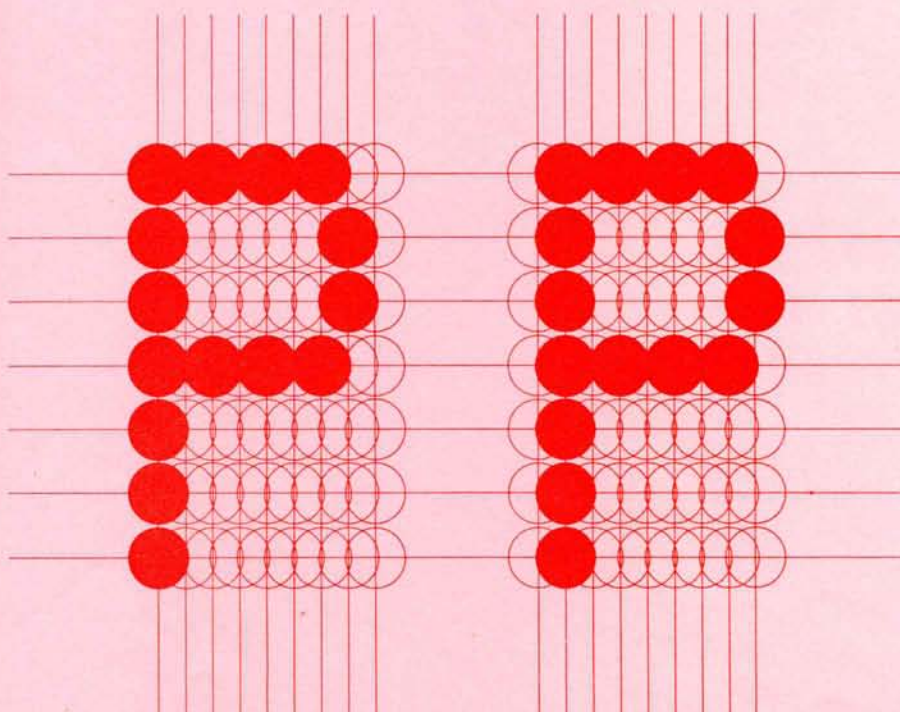
ALTERNATIVE
PROPOSAL



Both solutions acceptable for OCR applications.

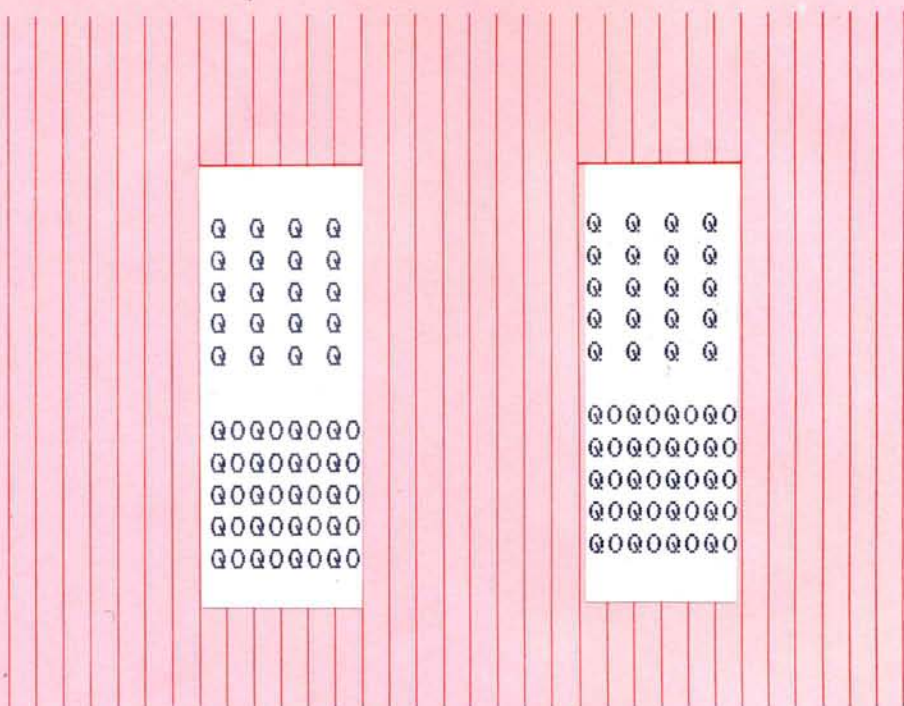
The ECMA solution has been moved a $\frac{1}{2}$ dot to the right to improve spacing and legibility.

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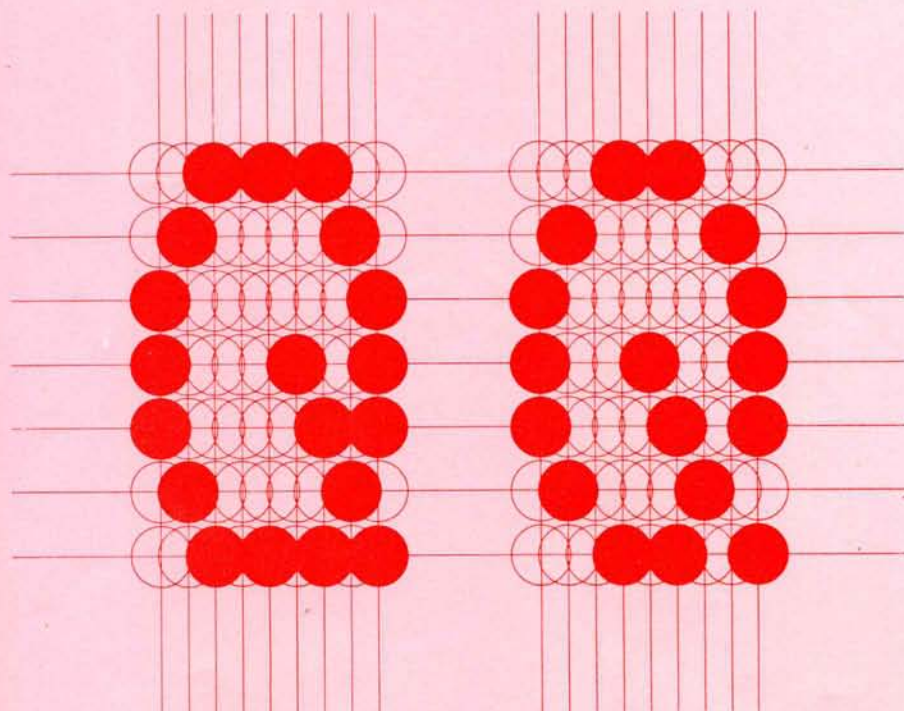
ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL



ECMA proposal Q-Zero = 2/12. Alternative proposal $\geq 4/0$.
 ECMA proposal Q-B = 2/16. Alternative proposal $\geq 4/0$.
 ECMA proposal Q-G = 2/18. Alternative proposal $\geq 4/0$.
 ECMA proposal Q-O = 2/24. Alternative proposal = 3/2.
 Increased "figural goodness", graphic unity with O, tail line emphasized.

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ECMA
 PROPOSAL

ALTERNATIVE
 PROPOSAL

R R R R
 R R R R
 R R R R
 R R R R
 R R R R

RMRMRMRM
 RMRMRMRM
 RMRMRMRM
 RMRMRMRM
 RMRMRMRM

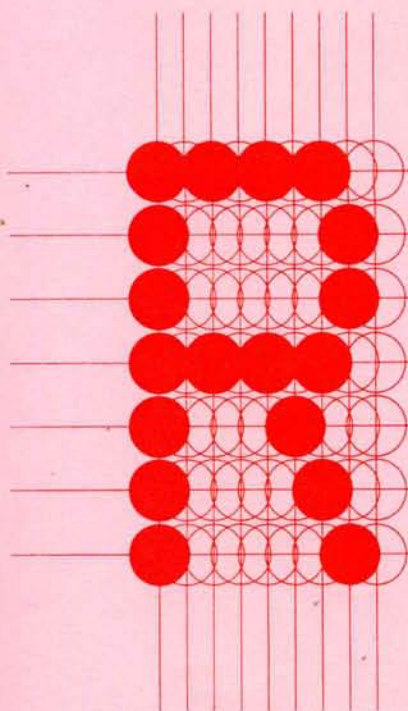
R R R R
 R R R R
 R R R R
 R R R R
 R R R R

RMRMRMRM
 RMRMRMRM
 RMRMRMRM
 RMRMRMRM
 RMRMRMRM

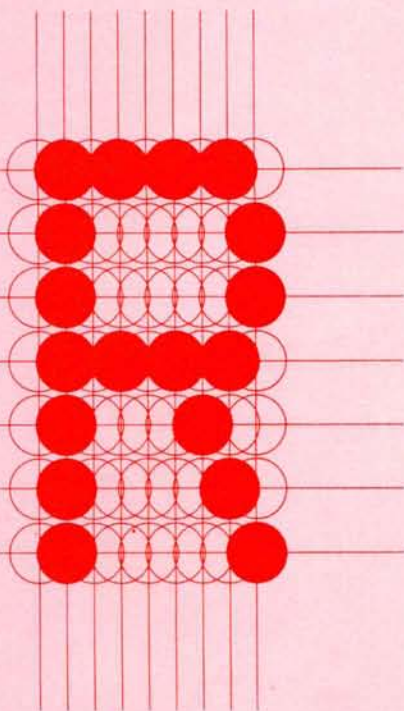
Both solutions acceptable for OCR applications.

The ECMA solution has been moved a ½ dot to the right to improve spacing and legibility.

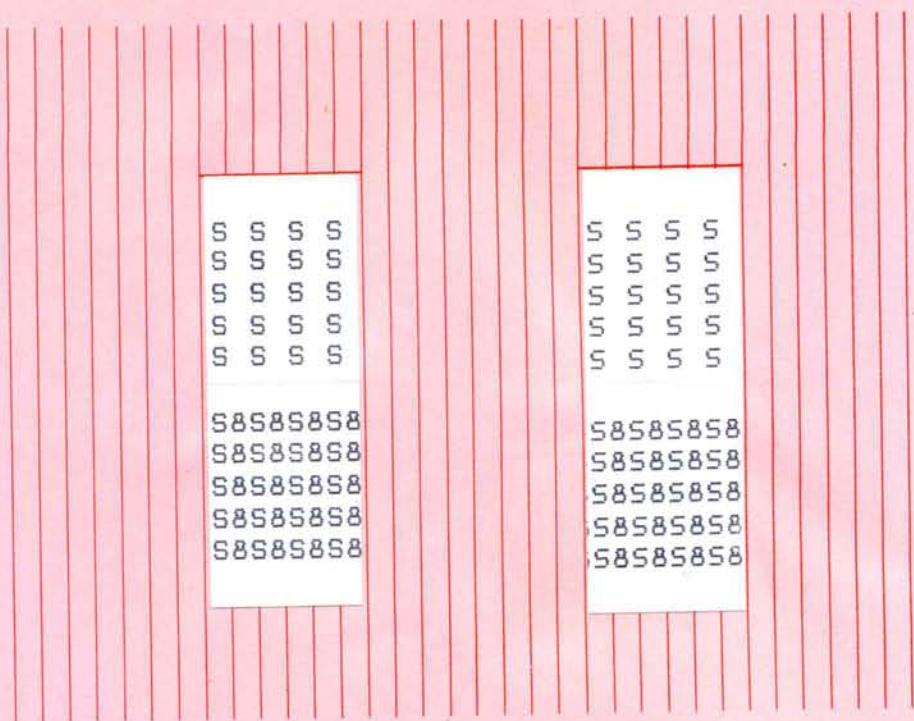
ARCHIVI DIGITALI OLIVETTI



ECMA
 PROPOSAL

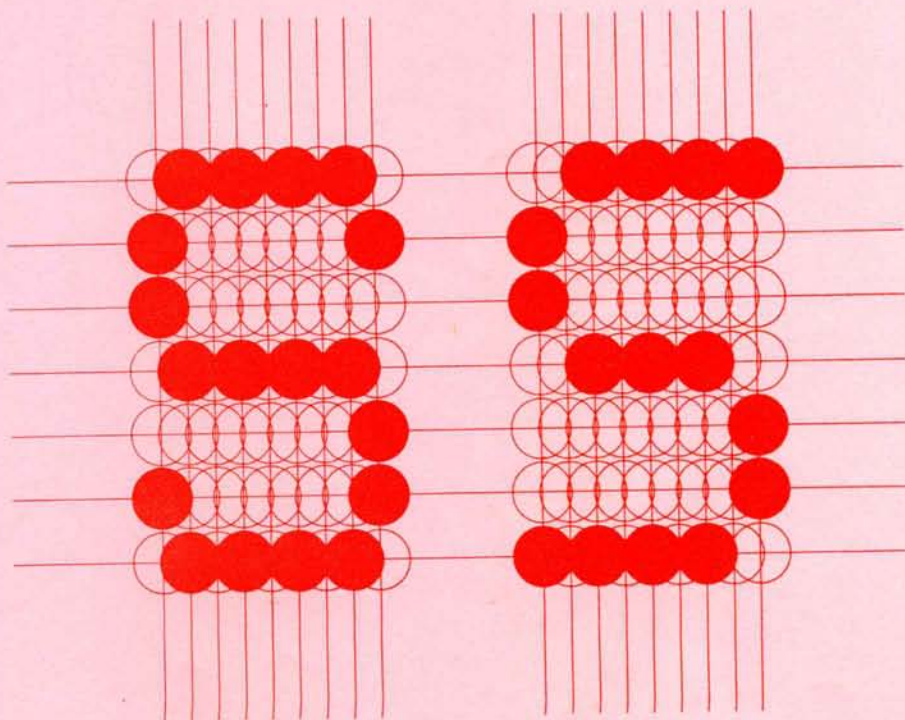


ALTERNATIVE
 PROPOSAL



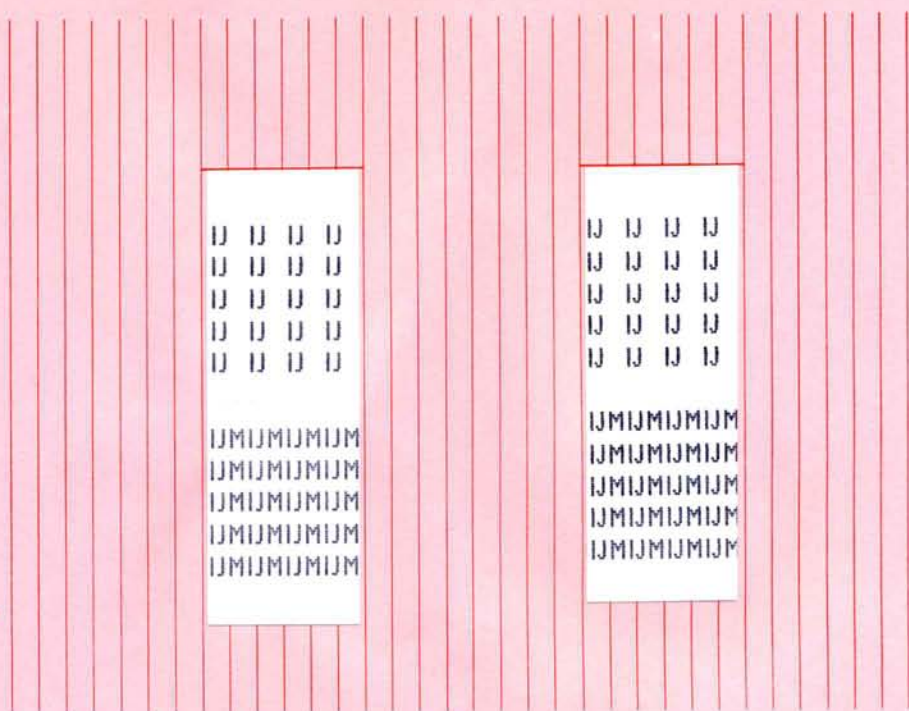
ECMA proposal S-B = 2/6. Alternative proposal $\geq 4/0$.
 A slight decrease in "figural goodness" has been accepted to obtain
 increased OCR readability.

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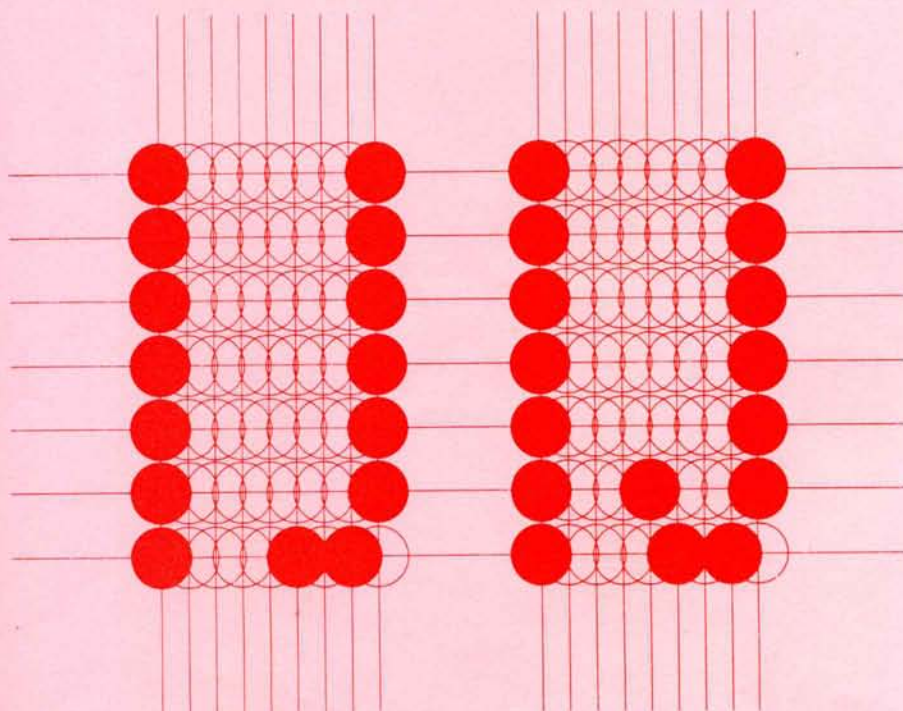
ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL



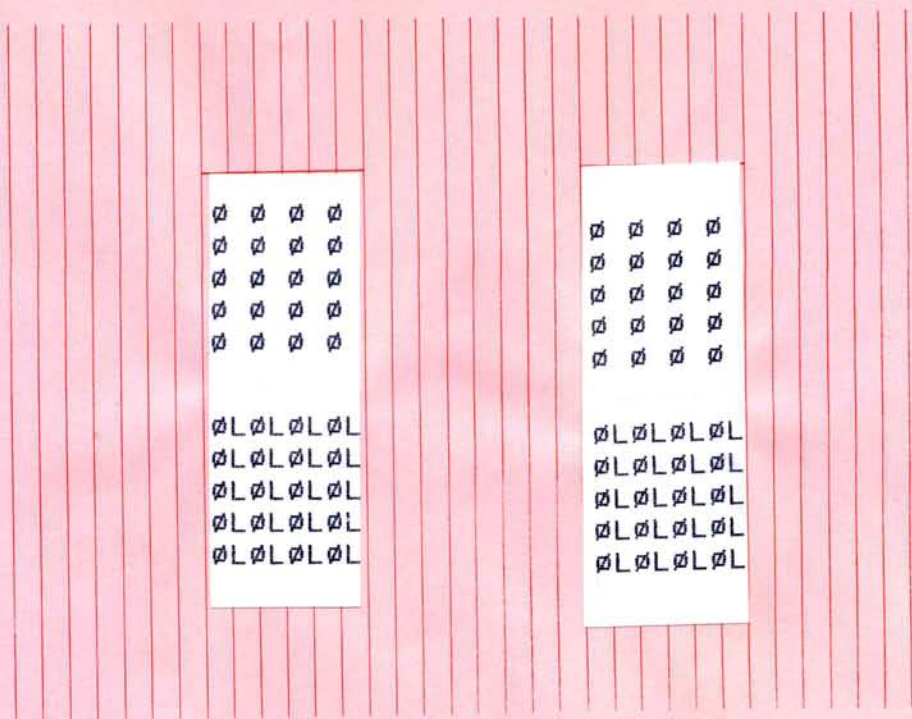
ECMA proposal IJ-U = 2/6. Alternative proposal = 3/6.
Increased "figural goodness".

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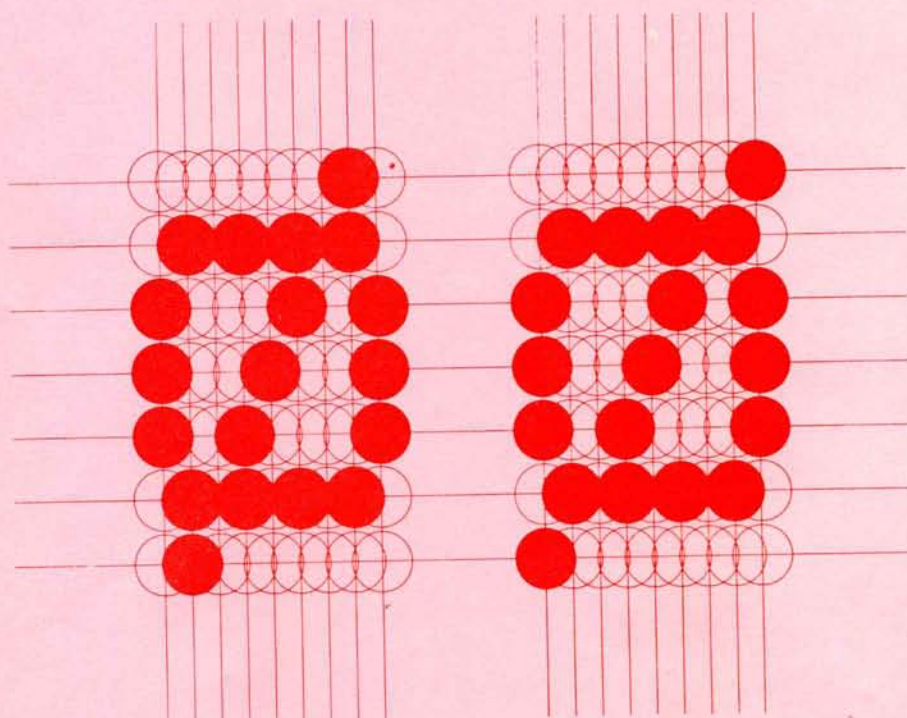
ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL



Both solutions acceptable for OCR applications.
Increased "figural goodness".

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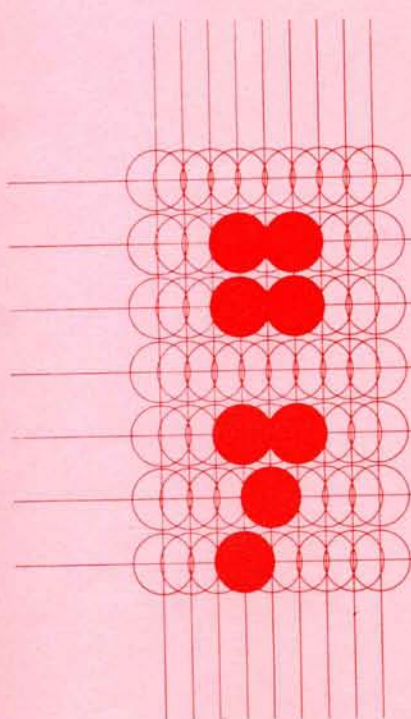
ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL

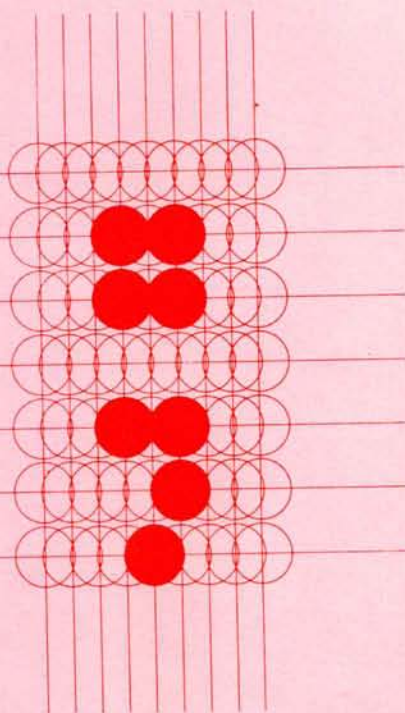


ECMA proposal ; — L.V.M. = 2/8. Alternative proposal = 2/8.
 ECMA proposal semi-colon — colon = 1/2. Alternative proposal = 1/8.
 Increased "figural goodness".

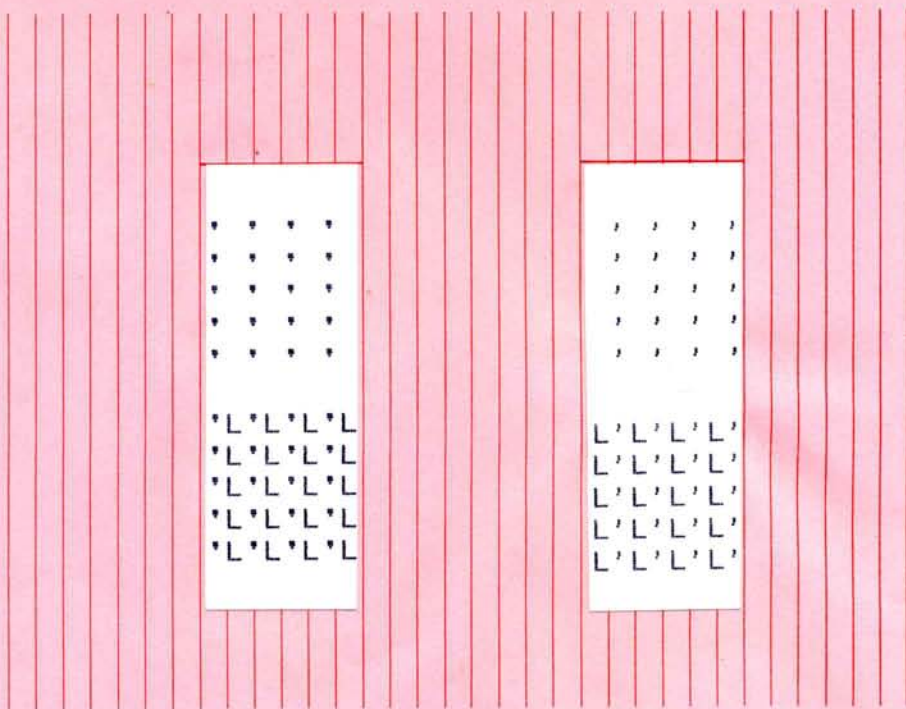
ARCHIVI DIGITALI OLIVETTI



ECMA
PROPOSAL

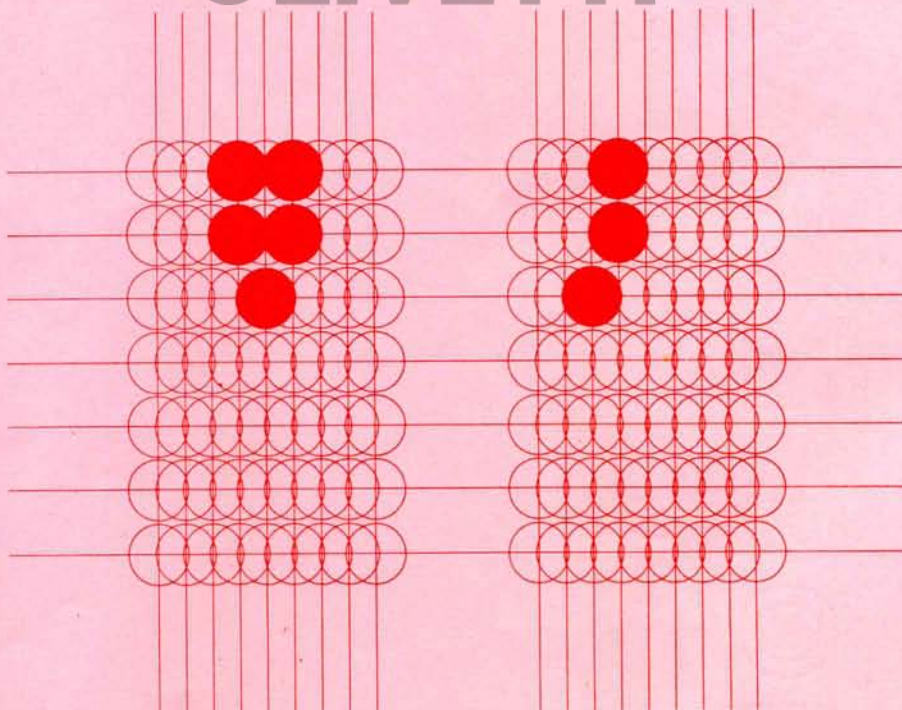


ALTERNATIVE
PROPOSAL



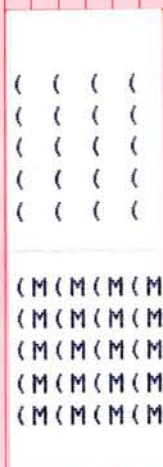
ECMA proposal apostrophe – ! = 2/2. Alternative proposal = 2/4.
 ECMA proposal apostrophe – comma = 2/4. Alternative proposal = 3/2.
 Increased “figural goodness”, lighter in weight.

ARCHIVI DIGITALI OLIVETTI



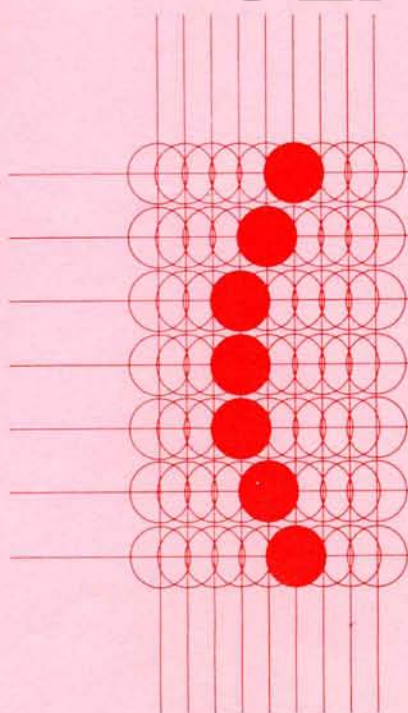
ECMA
PROPOSAL

ALTERNATIVE
PROPOSAL

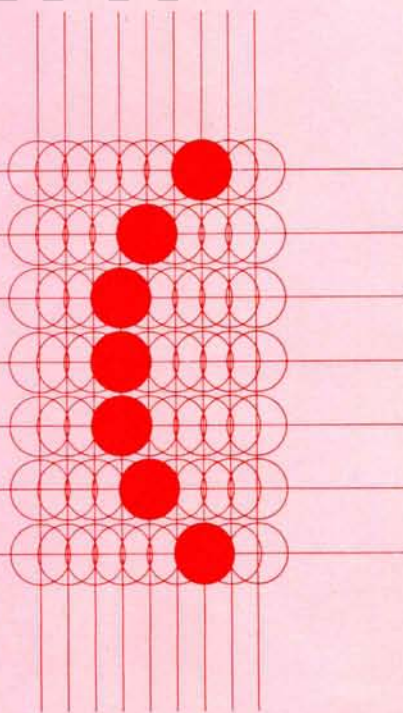


ECMA proposal (-1 = 2/10. Alternative proposal $\geq 4/0$.
 ECMA proposal (-L.V.M. = 0/10. Alternative proposal $\geq 4/0$.
 ECMA proposal (-! = 2/8. Alternative proposal $\geq 4/0$.
 Increased "figural goodness".

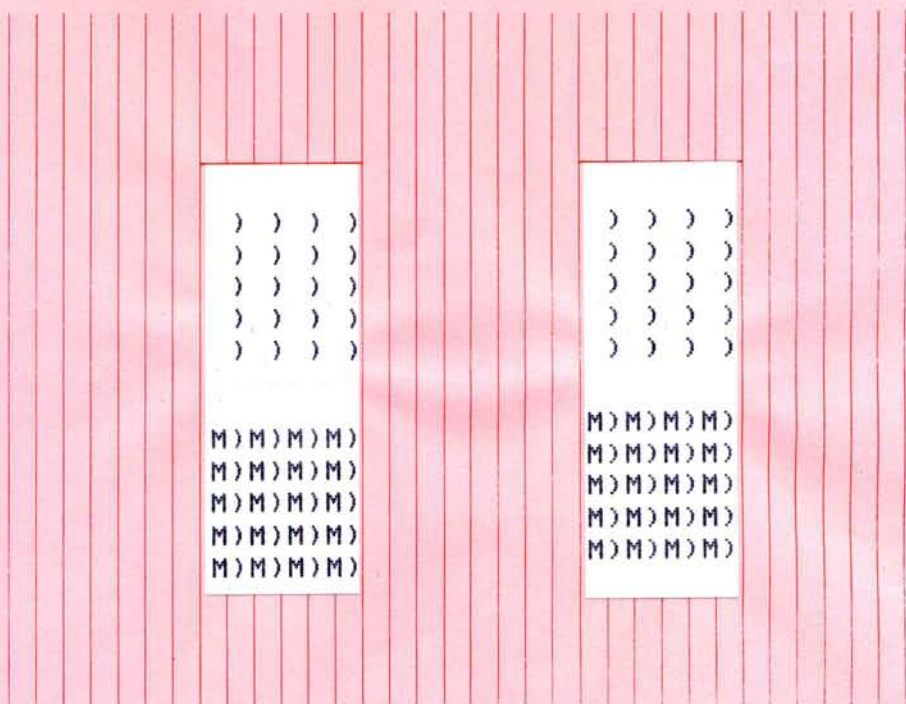
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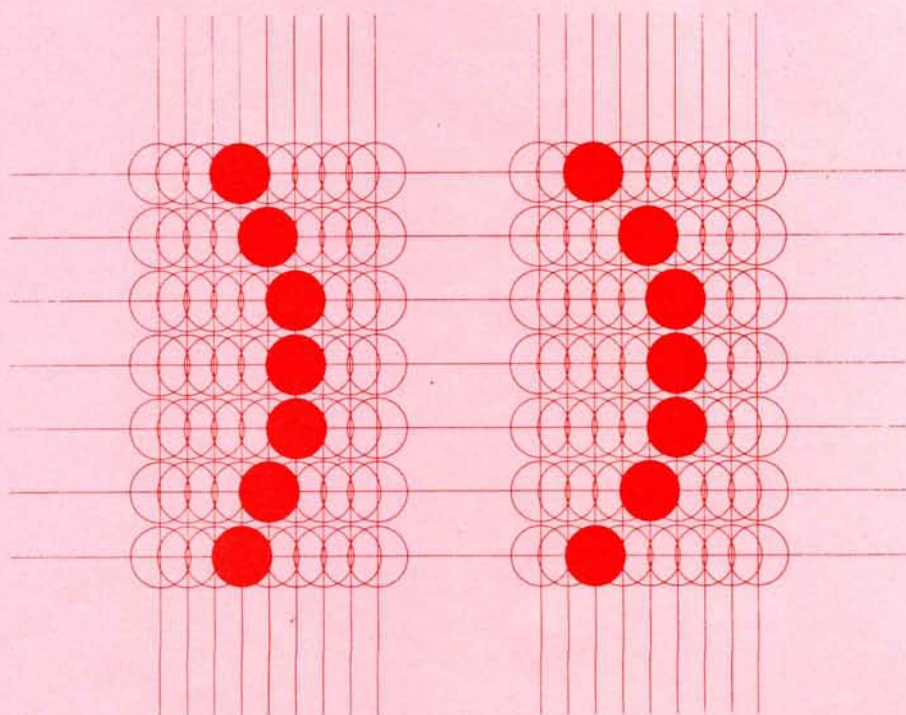
ECMA proposal)-1 = 2/10. Alternative proposal $\geq$ 4/0.

ECMA proposal)-L.V.M. = 0/10. Alternative proposal $\geq$ 4/0.

ECMA proposal)-I = 2/8. Alternative proposal $\geq$ 4/0.

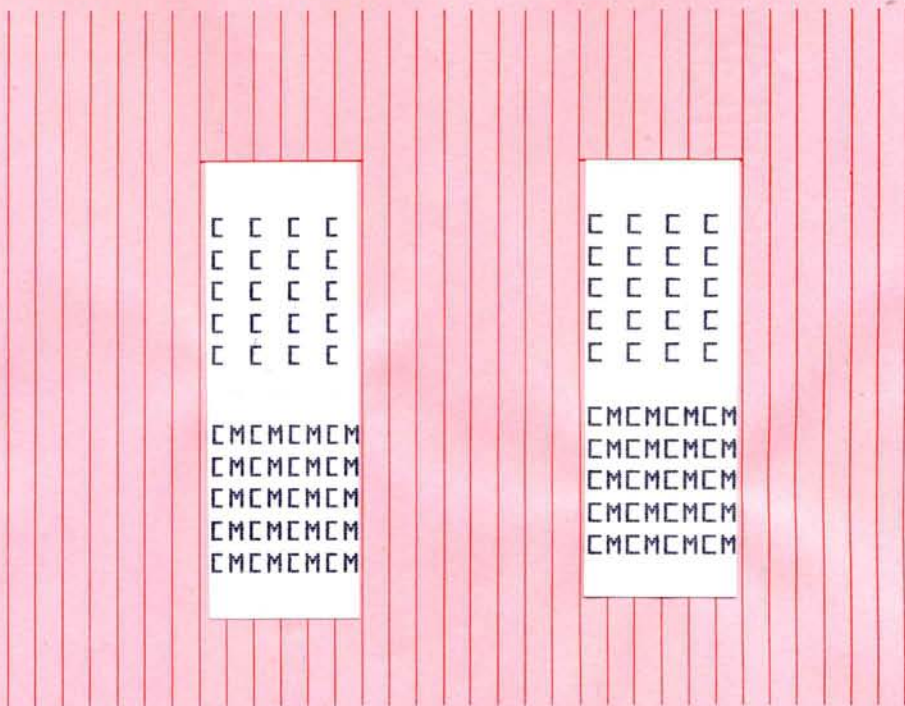
Increased "figural goodness".

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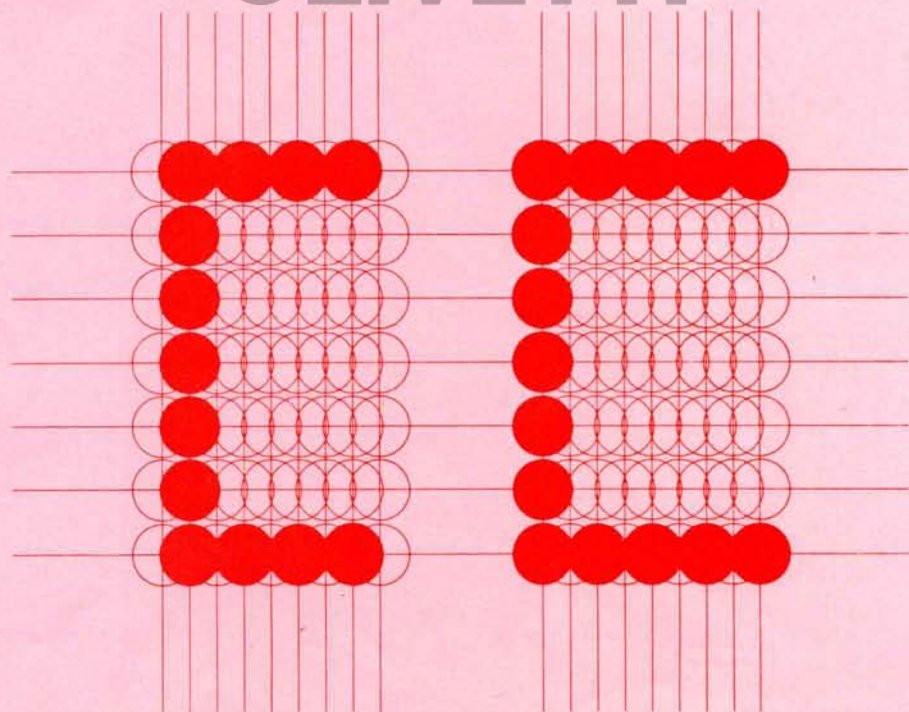
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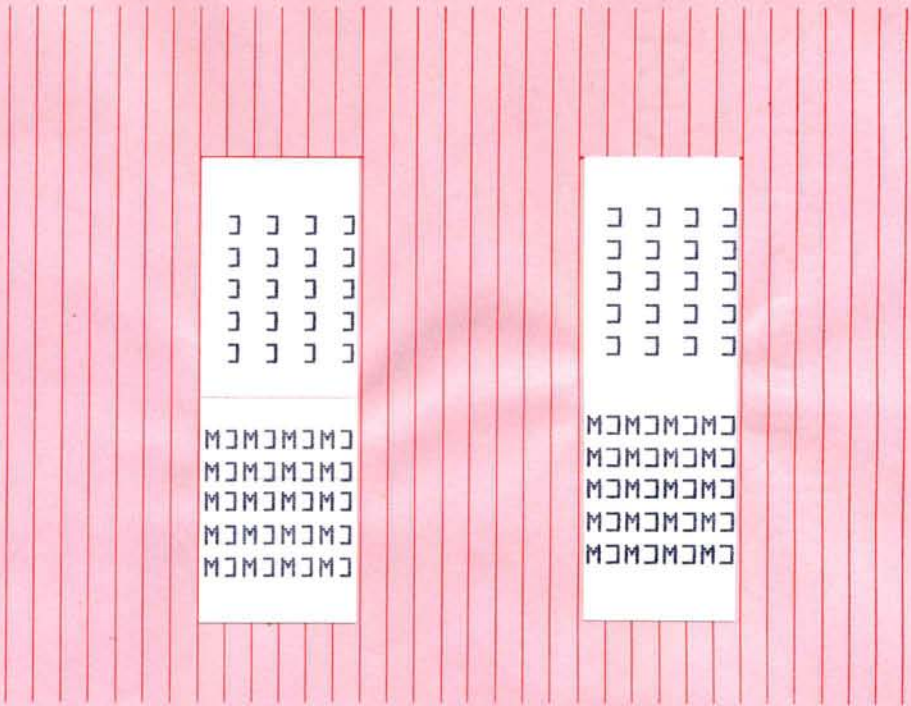
ECMA proposal [-C = 2/10. Alternative proposal $\geq 4/0$.
 ECMA proposal [-E = 2/14. Alternative proposal = 2/14.

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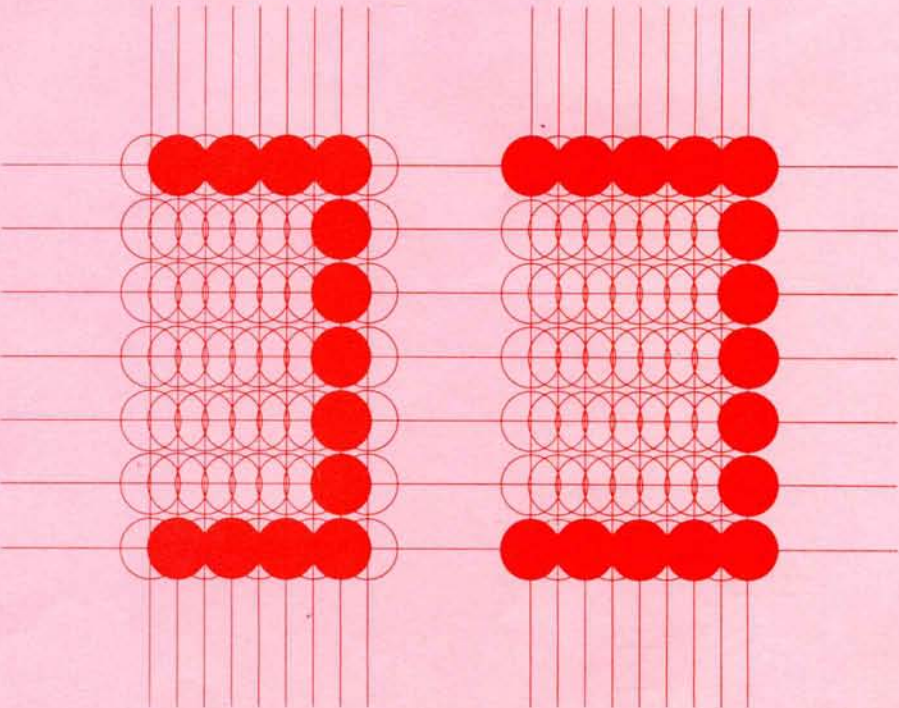
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Both solutions acceptable for OCR applications.

The alternative proposal has the same dimensions as the improved "left-hand" bracket.

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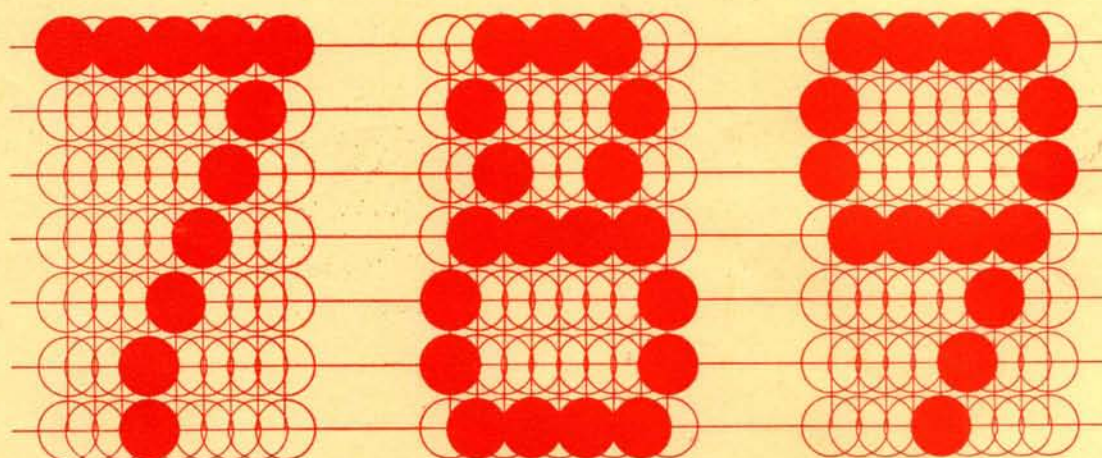
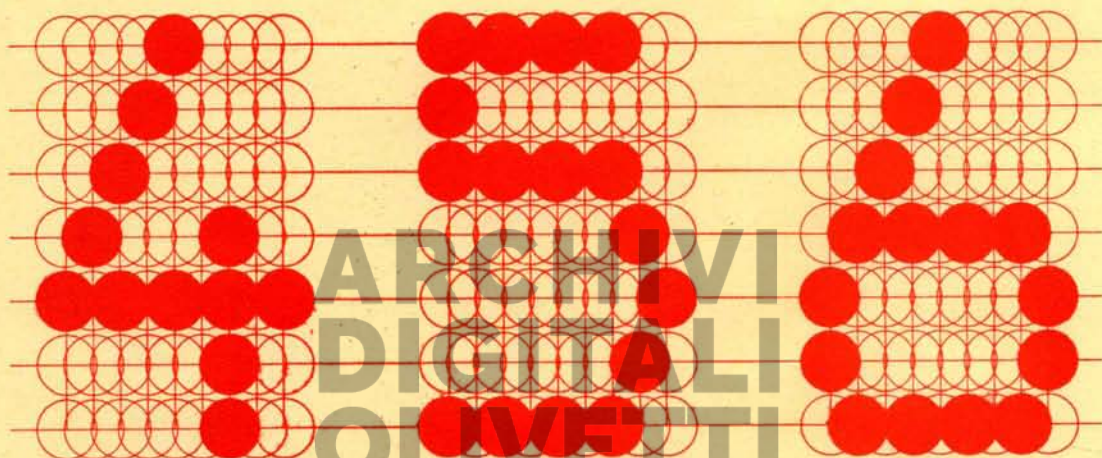
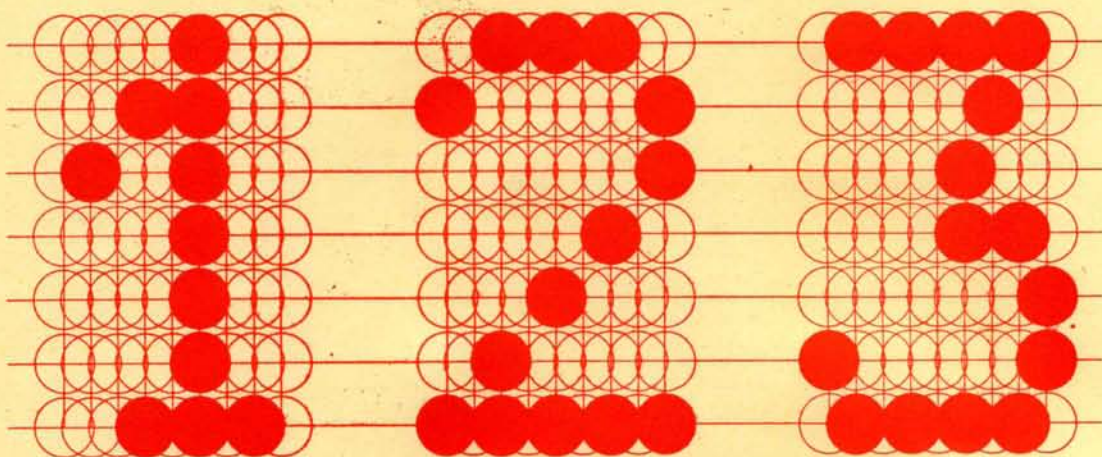


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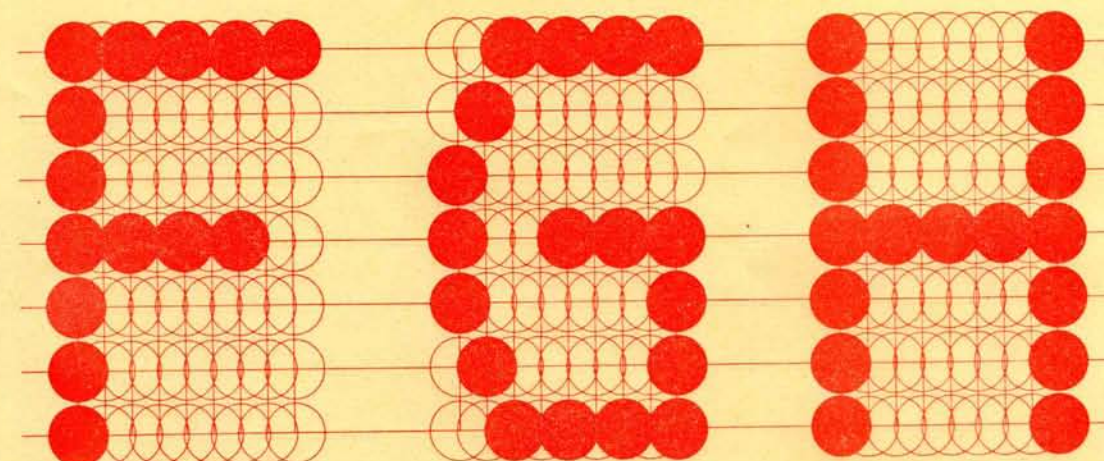
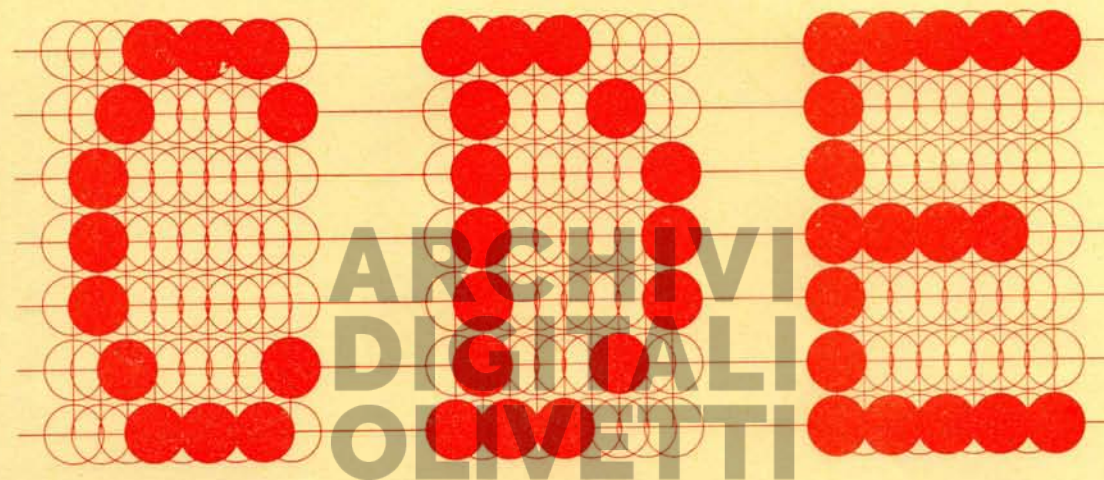
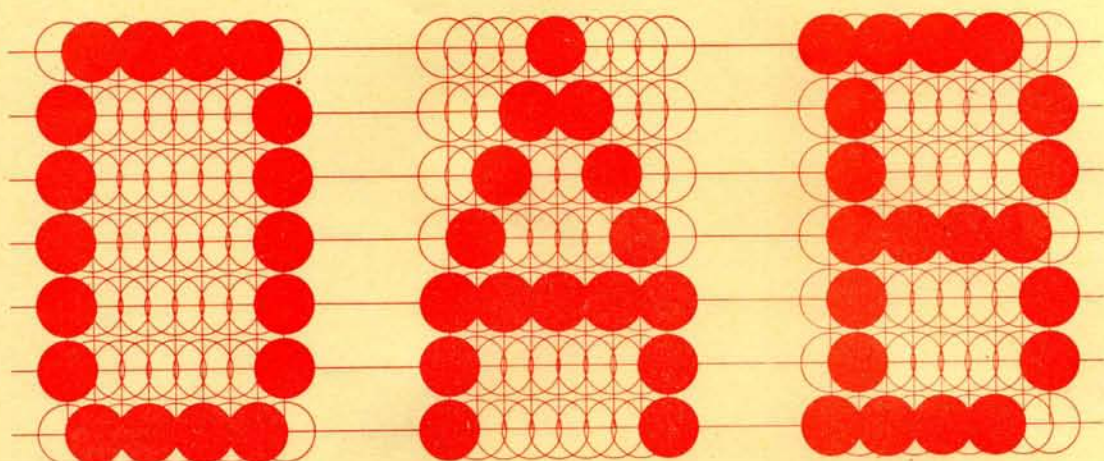
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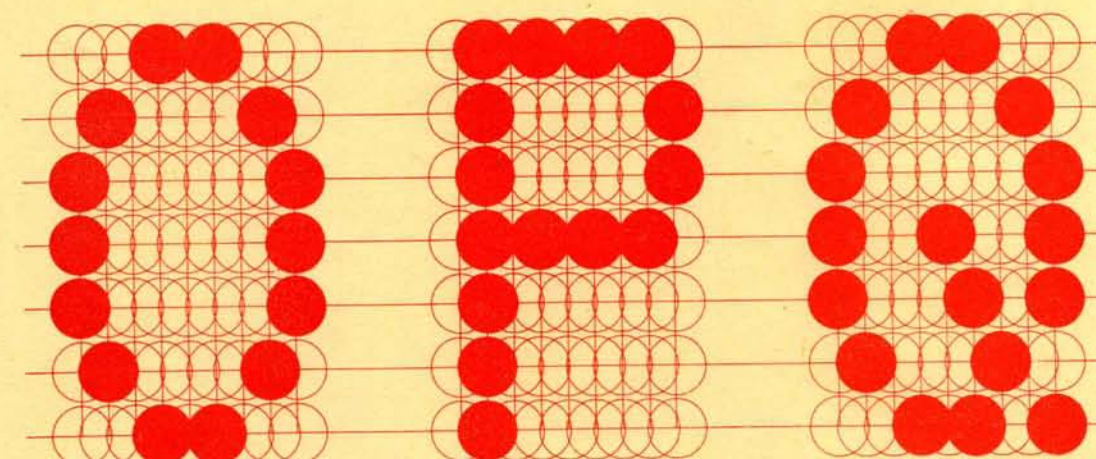
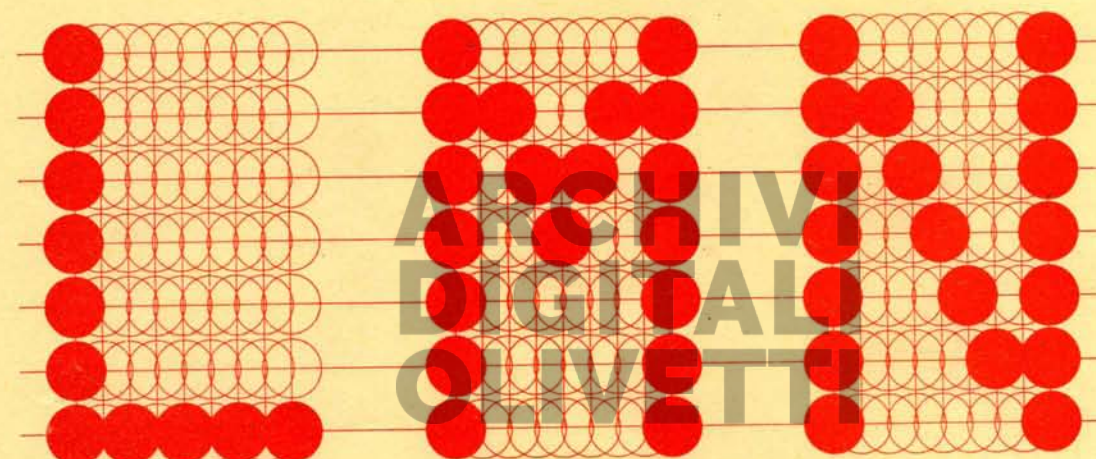
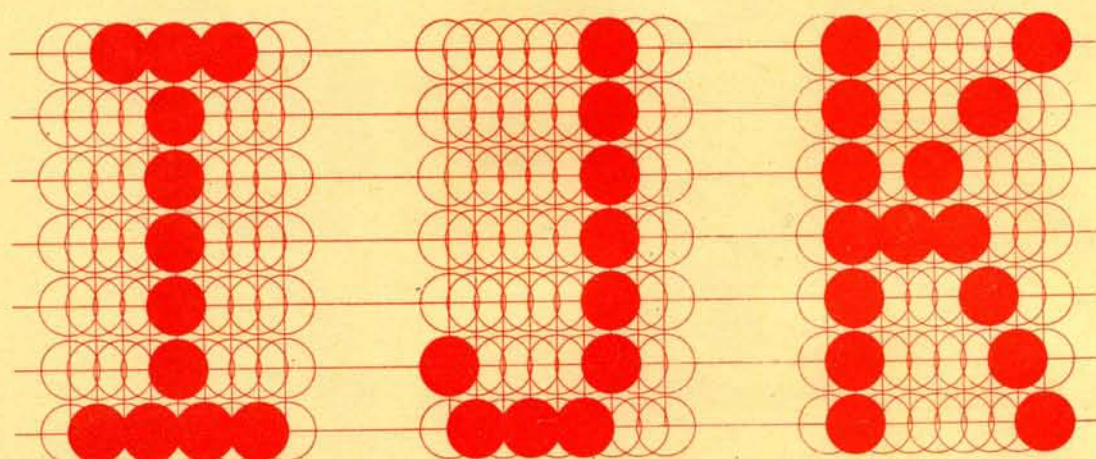
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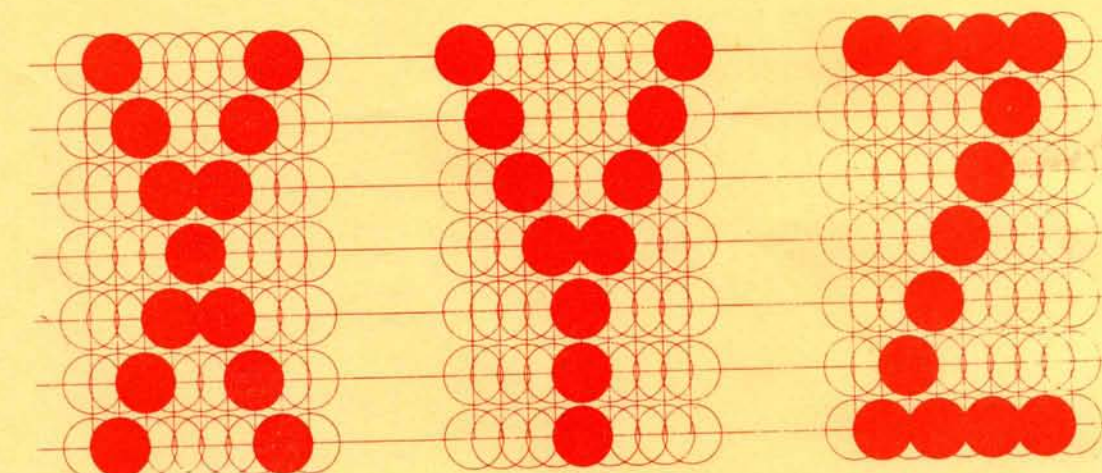
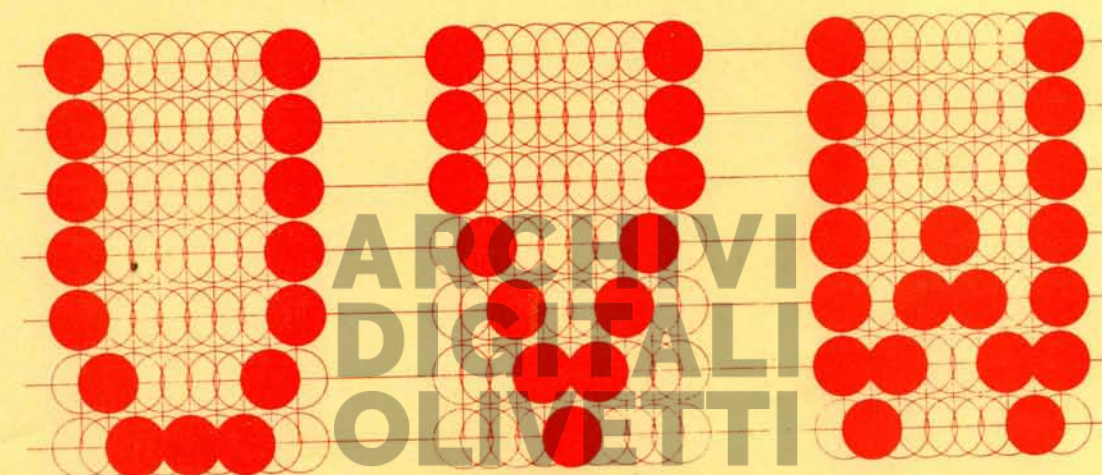
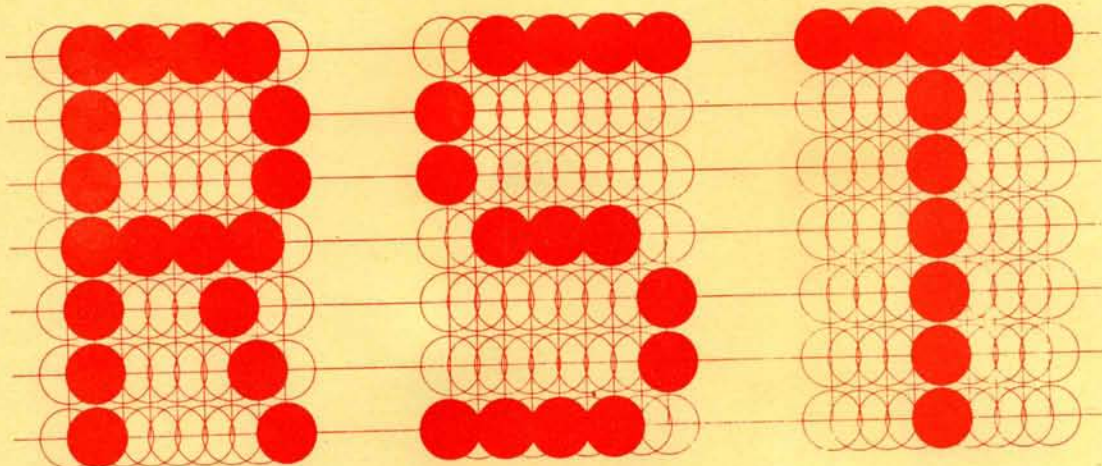
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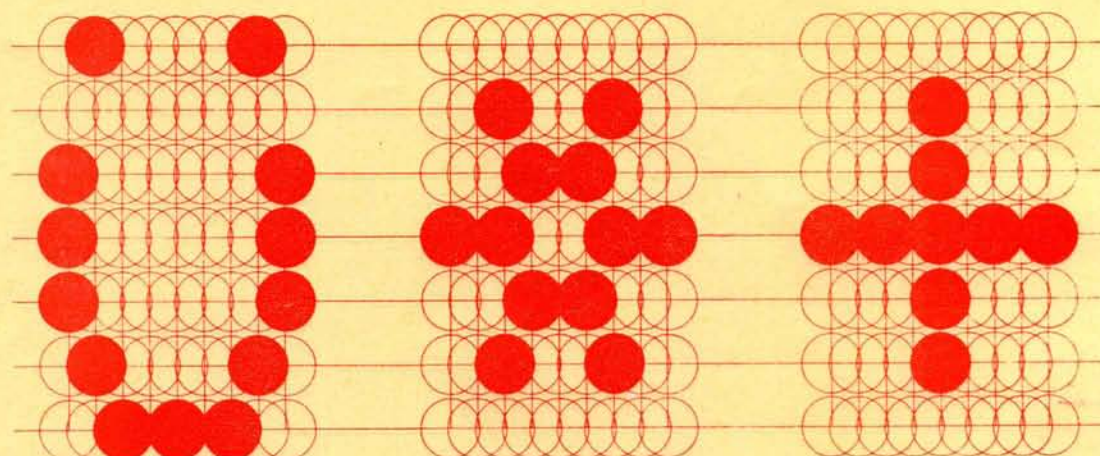
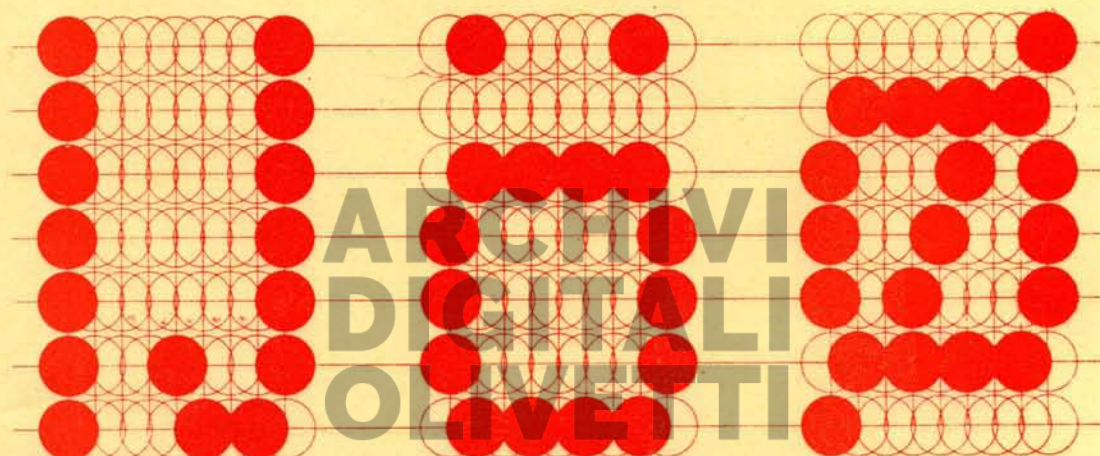
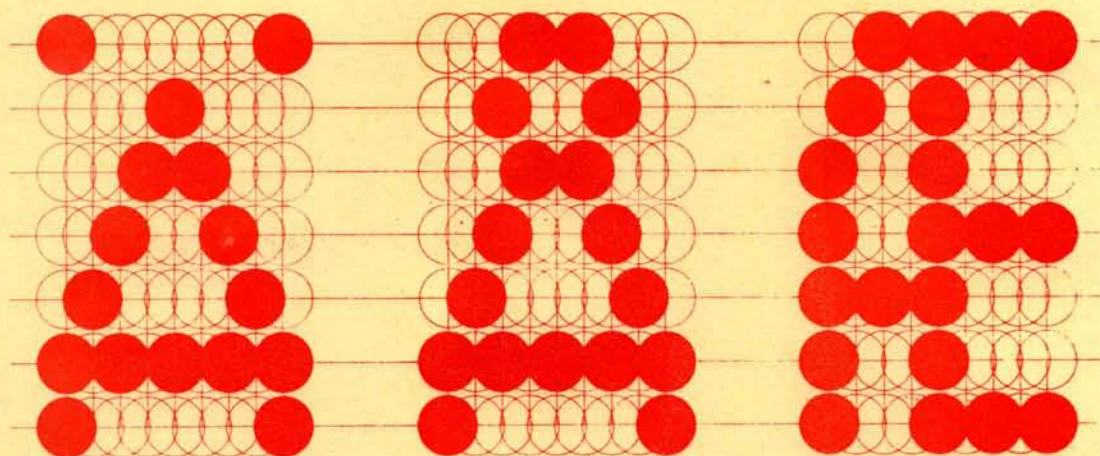
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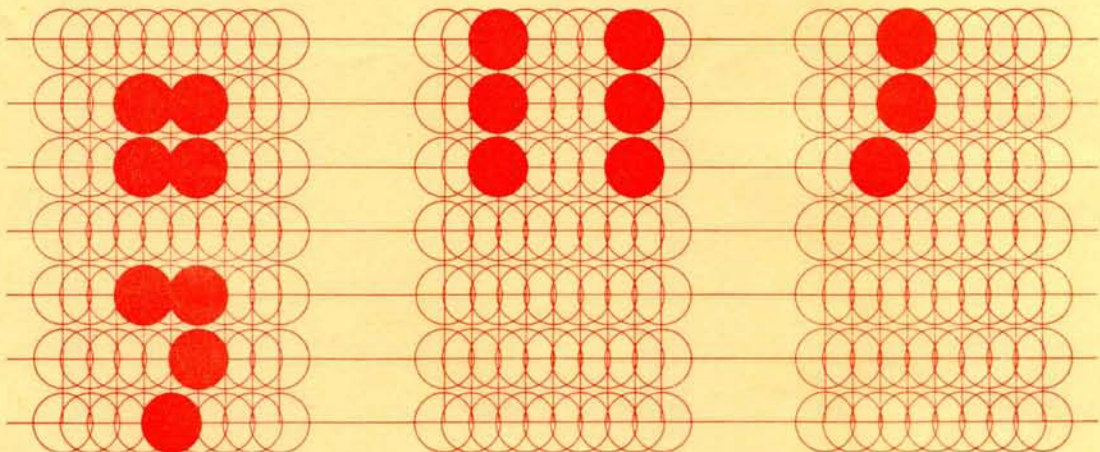
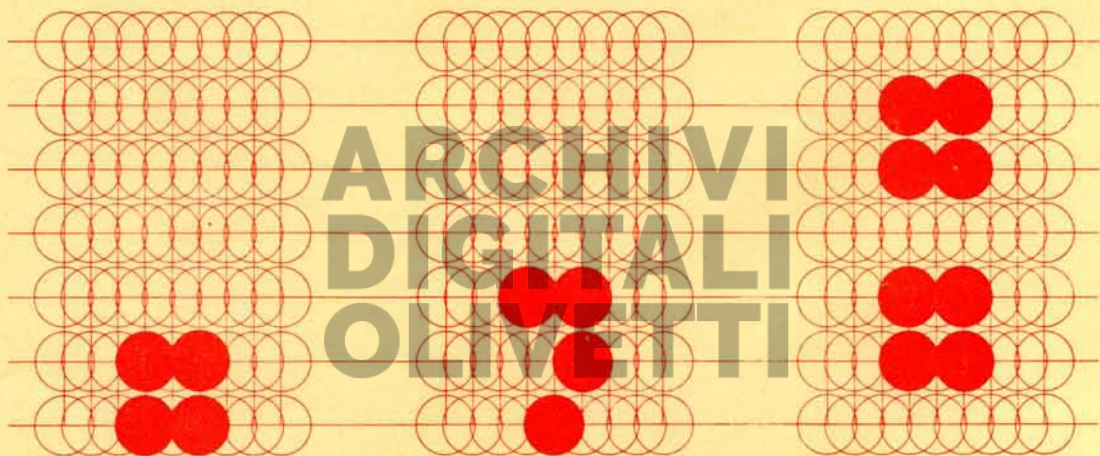
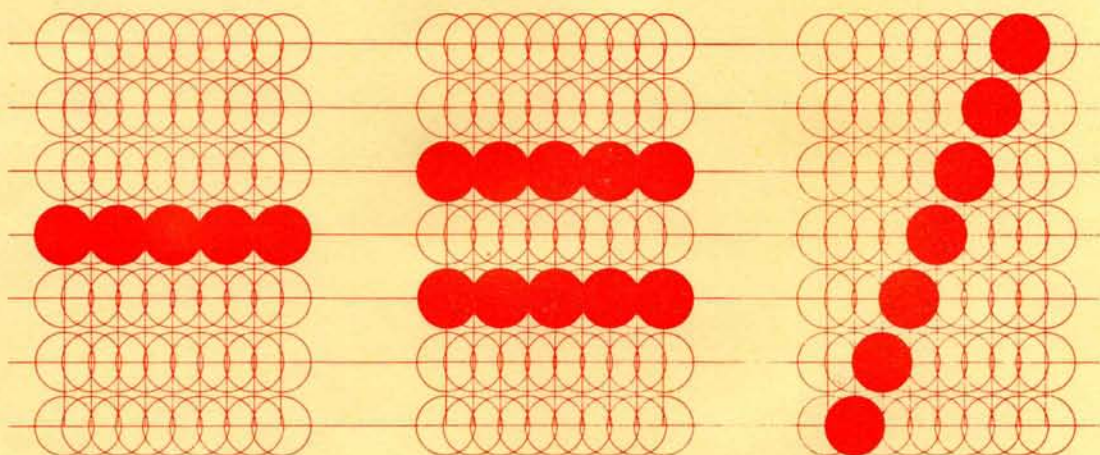
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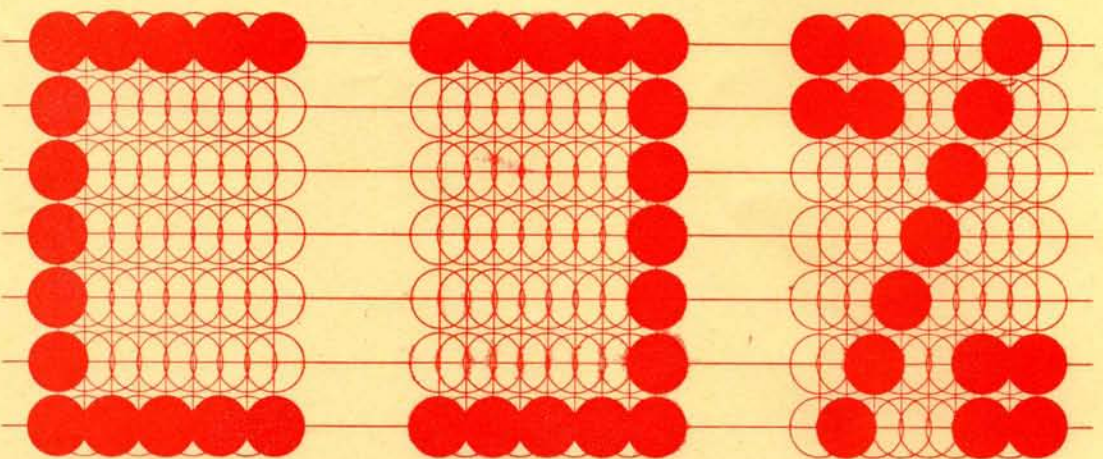
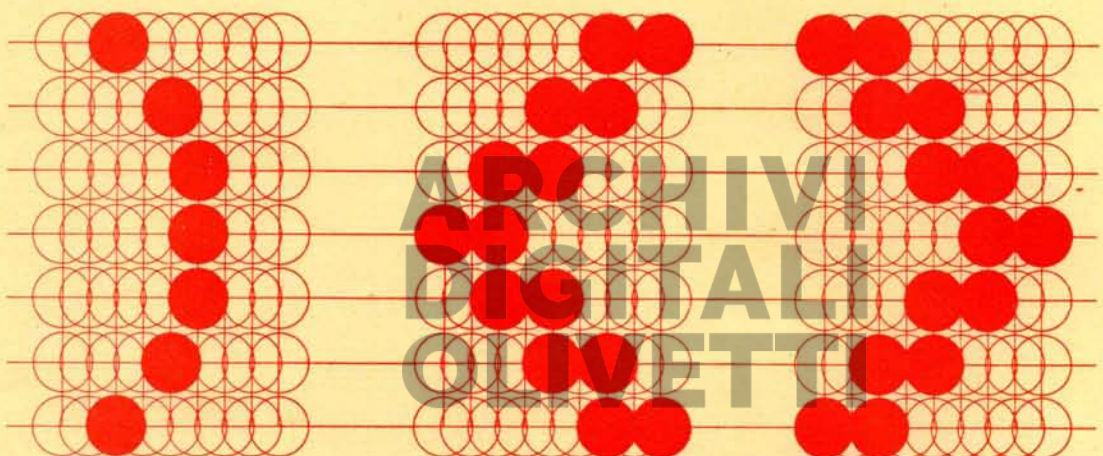
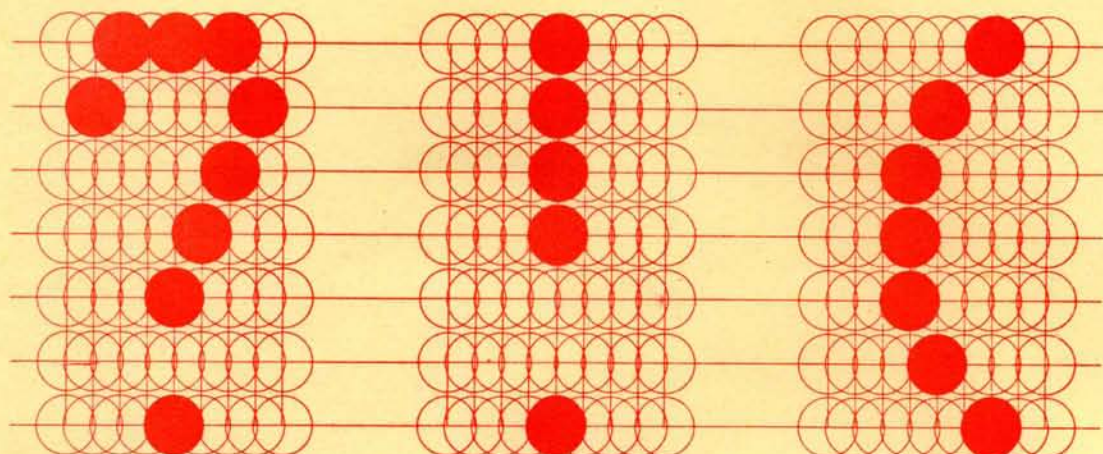
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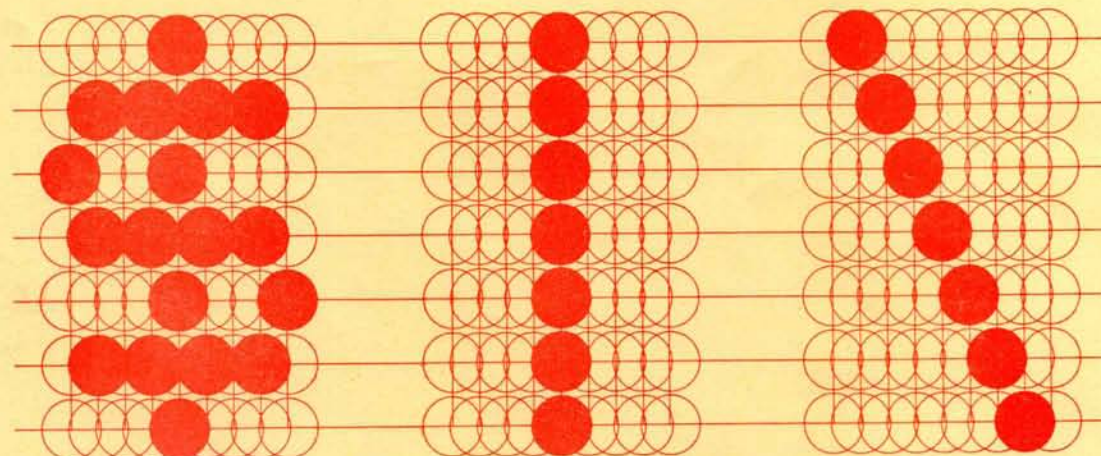
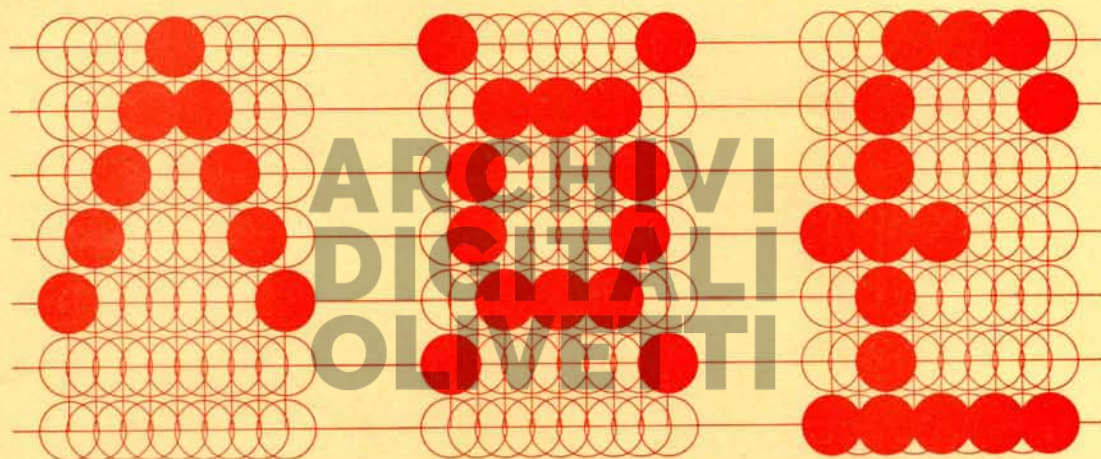
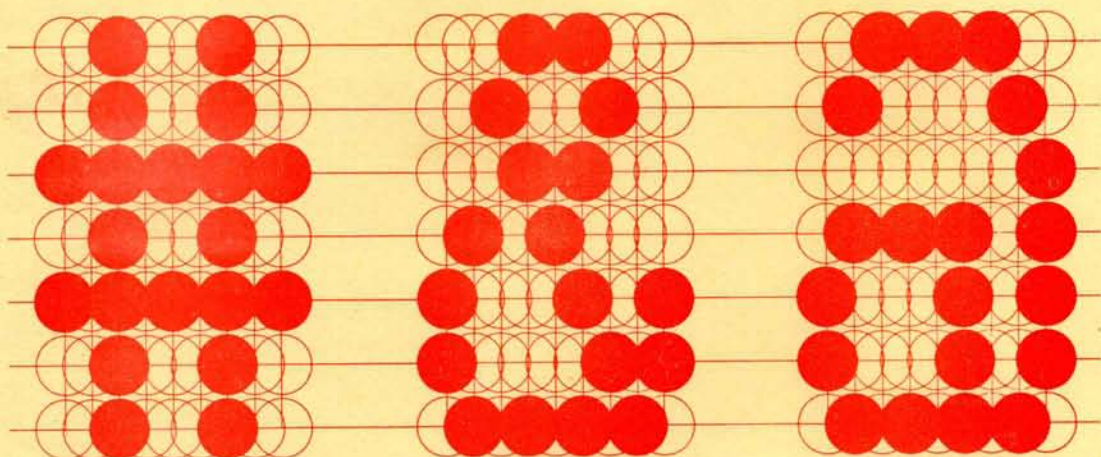
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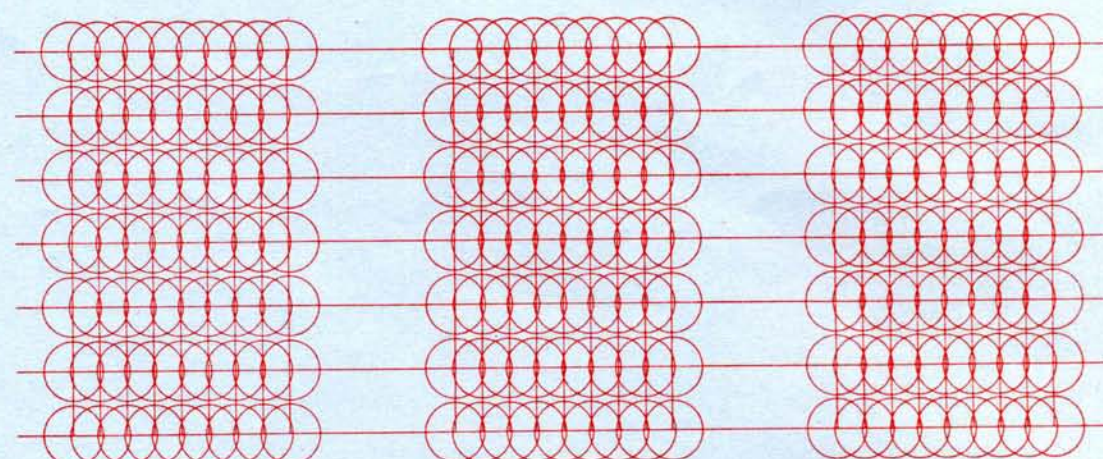
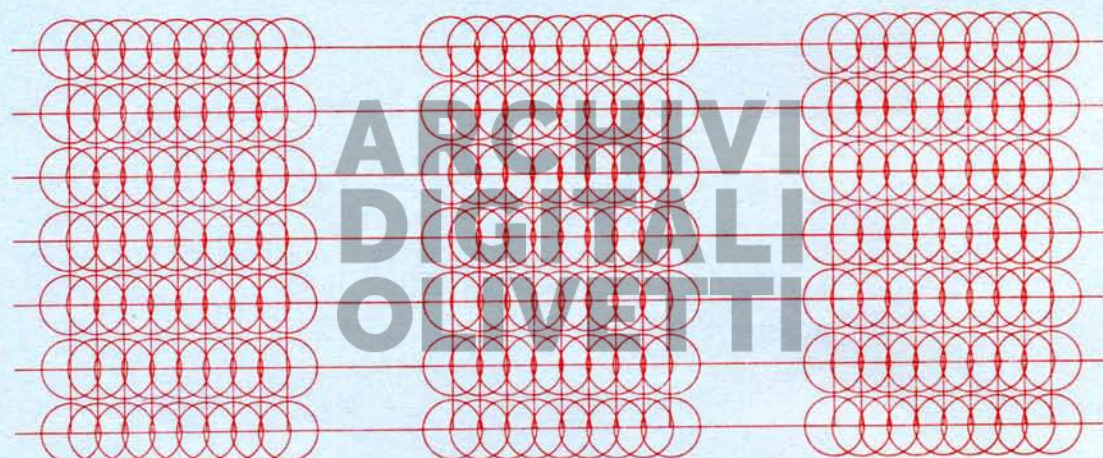
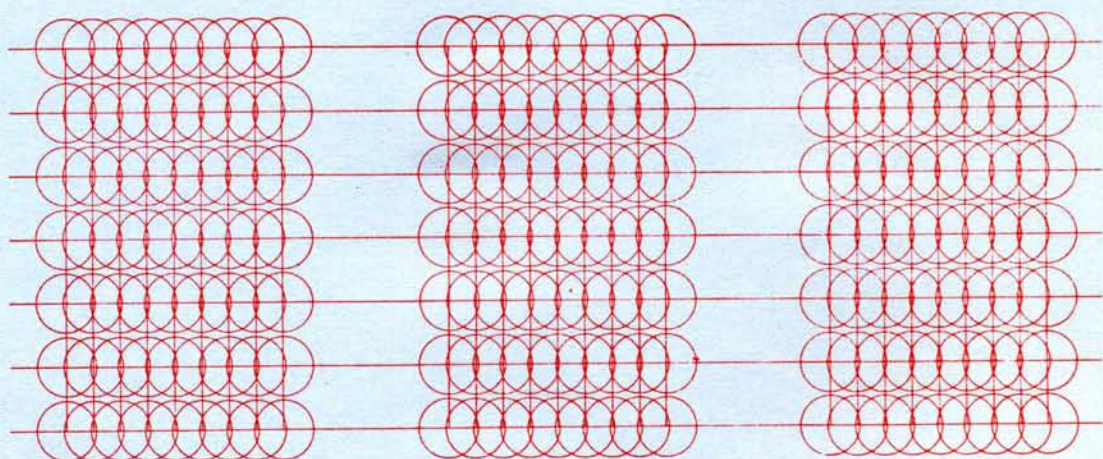
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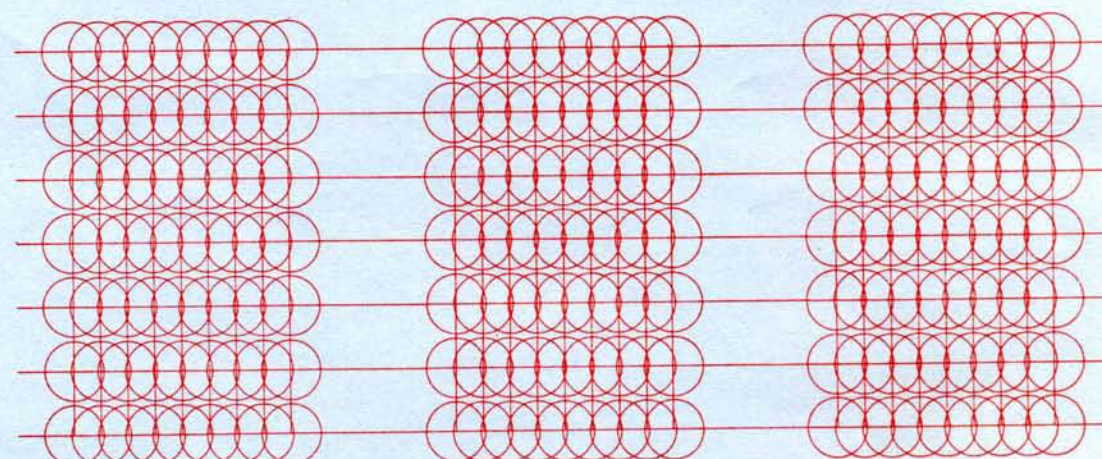
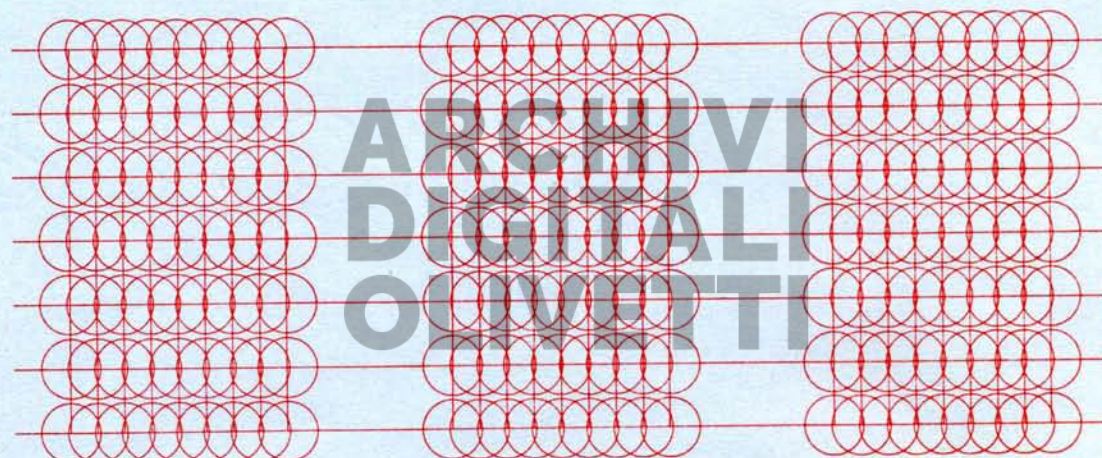
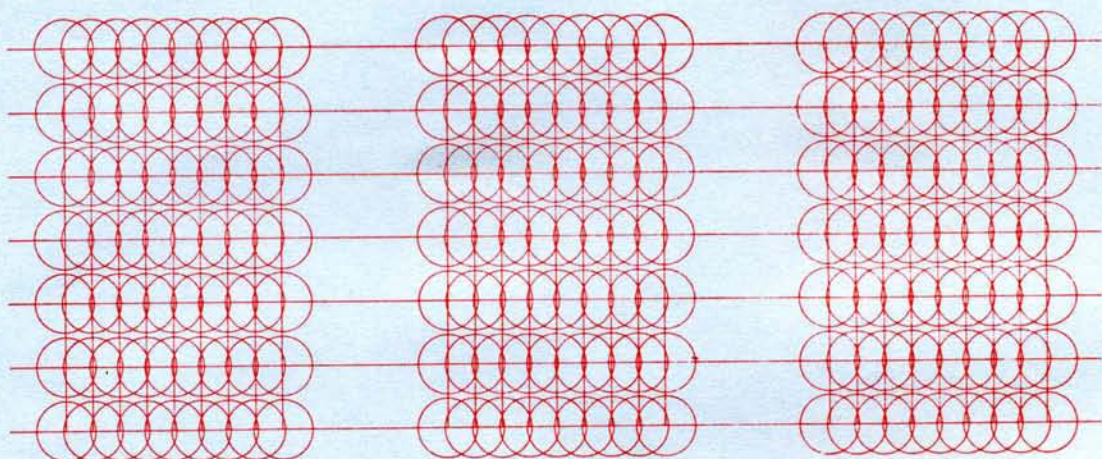
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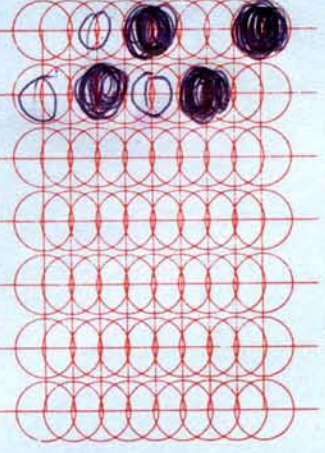
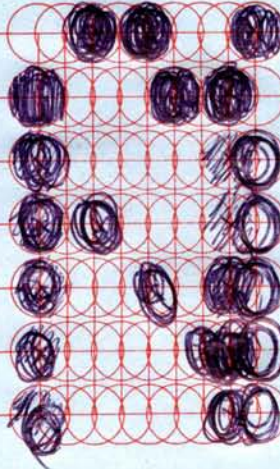
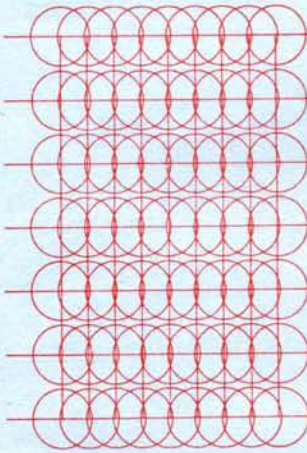


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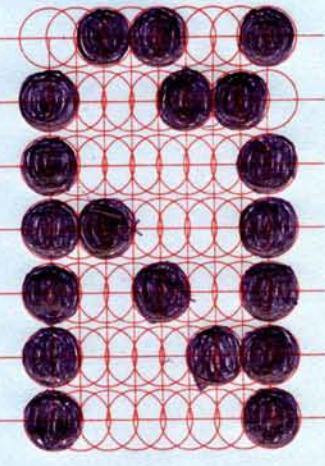
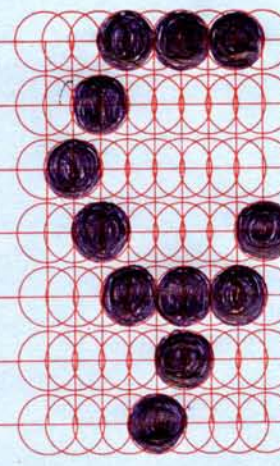
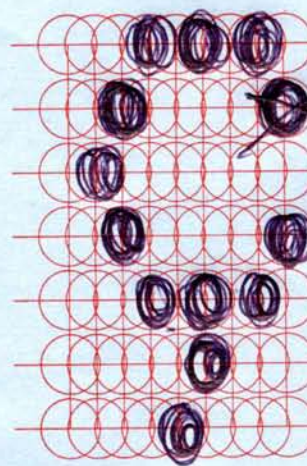
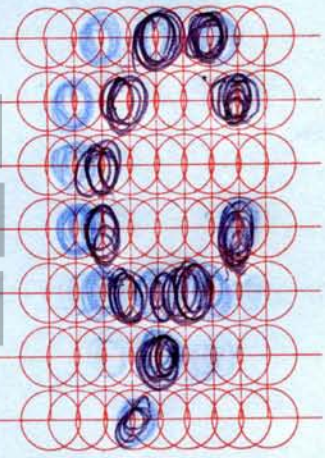
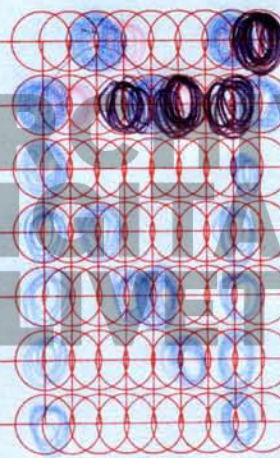
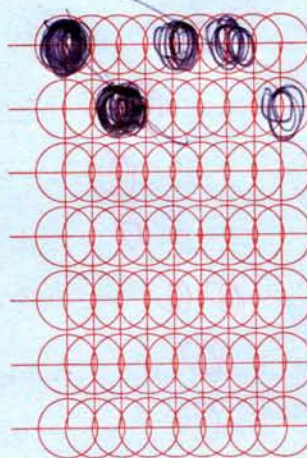
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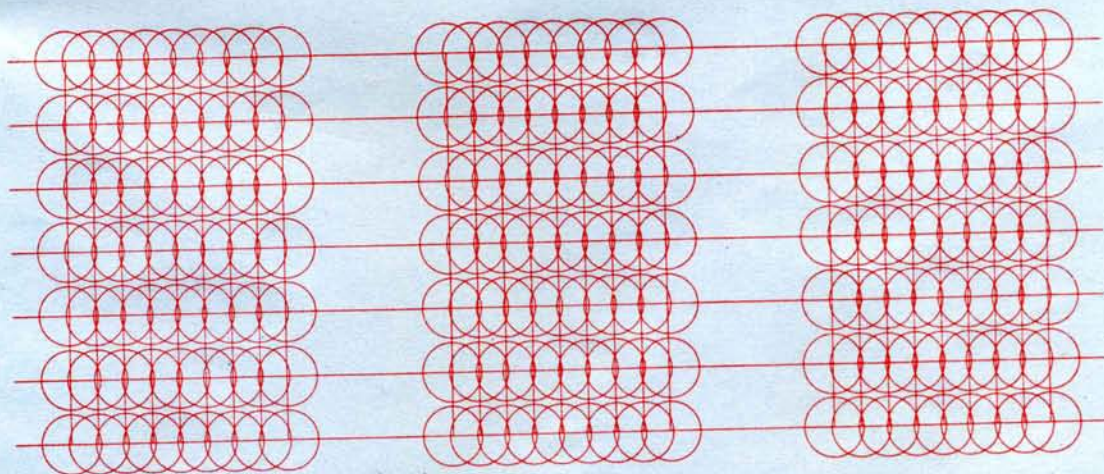
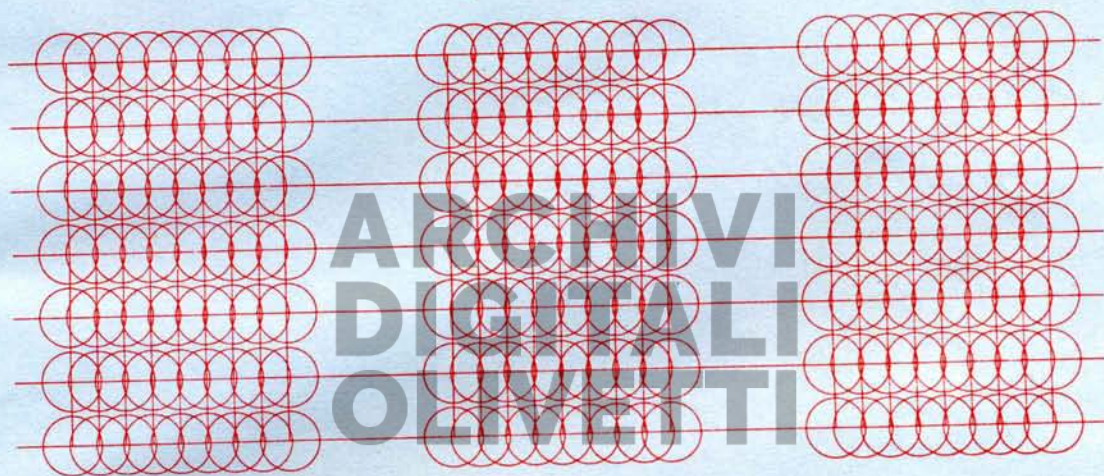
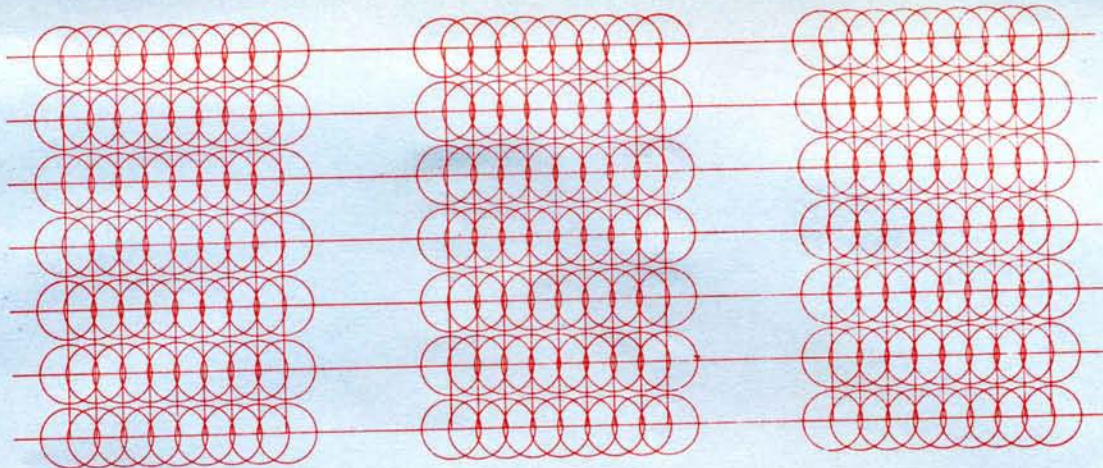


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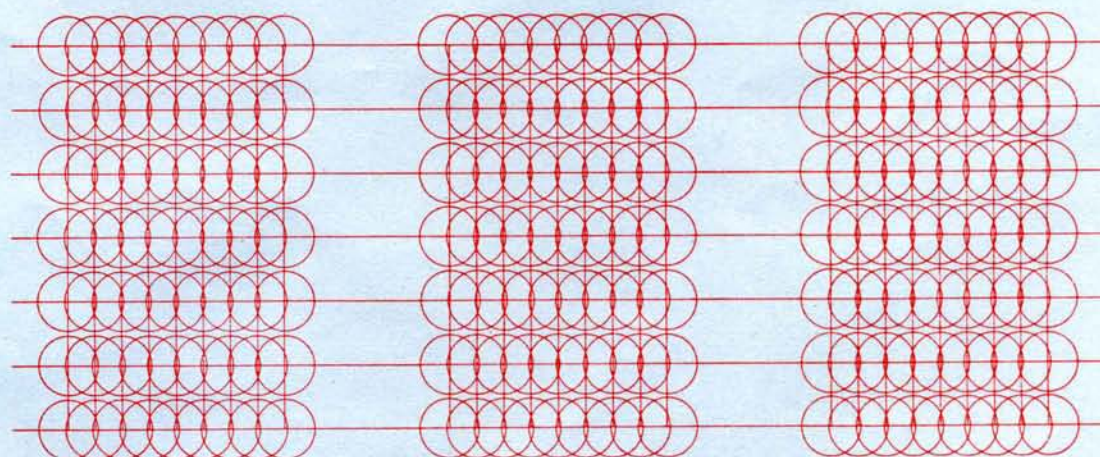
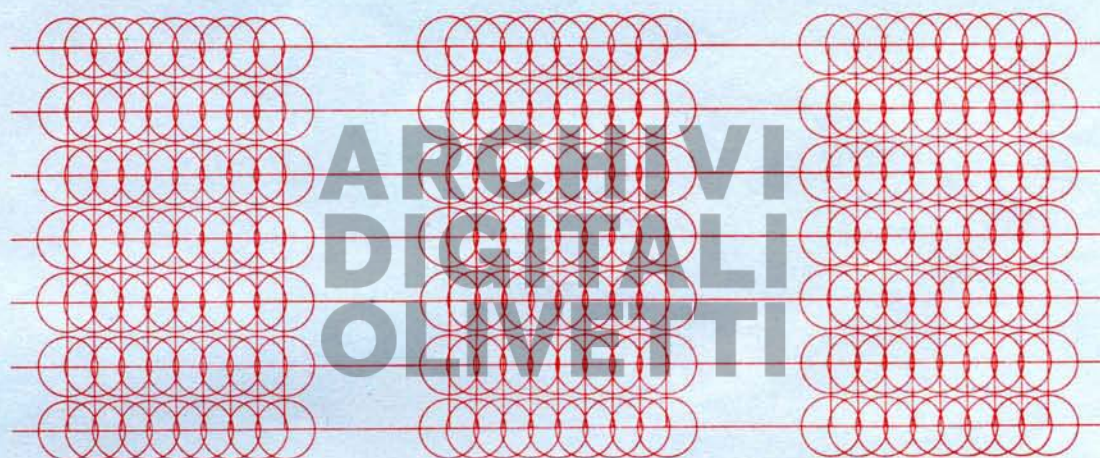
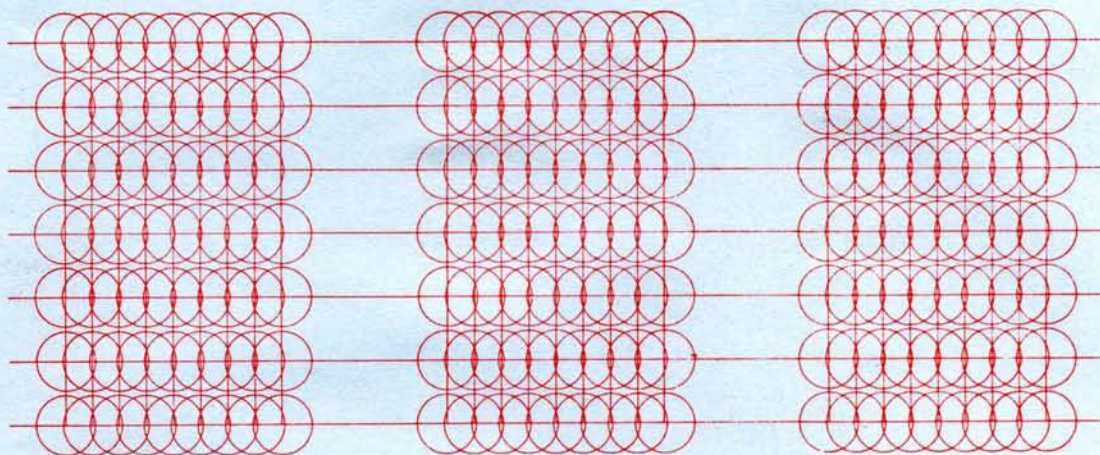
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