Enhancing and degrading visual stimuli

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Several assembly language routines are described for use in perceptual identification experiments on the Apple Macintosh computer with MS-BASIC. These routines are in a machine language library that may be accessed from BASIC. No knowledge of assembly language is required to use the statements. In one method of perceptual identification, stimulus clarification, a mask is gradually removed to reveal the stimulus behind it. The other method, stimulus materialization, displays the stimulus on the screen in a piecemeal fashion. Data are reported from a demonstration experiment in which prior exposure to words enabled subjects to identify those words more easily under impoverished conditions.

Measurements of perceptual identification have been used frequently to demonstrate the facilitation in performance resulting from previous experiences commonly referred to as *priming effects*. In the perceptual identification task, subjects are asked to identify a stimulus under visually degraded conditions. The general finding is that subjects are able to identify previously presented stimuli more rapidly than stimuli they have not seen before. This finding has been applied across a wide range of areas and in numerous situations. For example, Gollin (1960) used degraded images of line drawings to examine learning in children. Cermak, Talbot, Chandler, and Wolbarst (1985) applied the technique to the study of perceptual priming in amnesic patients. Johnston, Dark, and Jacoby (1985) employed a perceptual identification task with college students to assess priming for words and pseudowords.

This paper describes several assembly language routines that can be used to conduct experiments involving perceptual identification on the Macintosh using Microsoft BASIC (MS-BASIC, version 2.0 or later). The routines create masks and present degraded images of the stimulus on the screen. Although the routines are presented in the context of their use pertaining to perceptual identification, they may be applied to many other situations.

The routines allow the implementation of two variations of the perceptual identification task. In the first method, *stimulus clarification*, a random-dot noise pattern, or mask, is superimposed over the stimulus. The resulting degraded image is then clarified gradually by removing a specified portion of the mask at a rate that is either preset or paced by the subject. Clarification may end at a predetermined point or when the subject makes a response. Figure 1 illustrates three possible steps in the clarification of the word *Ebbinghaus*. The second method

Figure 1. Three possible steps in the clarification of the word *Ebbinghaus*.

of perceptual identification is *stimulus materialization* in which the stimulus gradually appears, pixel by pixel, on a blank screen. This procedure creates the illusion that the stimulus is materializing on the computer screen, as illustrated in Figure 2. As with stimulus clarification, stimulus materialization continues until a preset limit is reached or the subject makes a response.

Vokey, Baker, Hayman, and Jacoby (1986) provided several assembly language programs for the Apple II that can be used to study perceptual identification. The Macintosh, with its sophisticated microprocessor and high-quality graphics, is also well suited for such research. Indeed, the standard formats for graphics on the Macintosh allow BASIC and other programming languages to access stimuli that have been created by other applications.

As implemented on the Macintosh, MS-BASIC gives programmers the ability to extend the BASIC language through the inclusion of their own assembly language routines. The routines are placed in what is known as a library

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Figure 2. Three possible steps in the materialization of the word *Ebbinghaus*.

and made available simply by including BASIC's `LIBRARY` statement at the beginning of the program. Any routine in the library can be used with a single statement, just as you would use any BASIC command. Therefore, no knowledge of assembly language is required to use the routines described in this paper, which are contained in a machine language library called `PIDLib`. Appendix A contains the syntax for each routine. The hex codes are provided in Appendix B so that programmers may enter the code segments directly into their libraries using programs such as `ResEdit`. The code for `LibInit` is included so that new libraries may be created.

THE ROUTINES

Bit Images

The stimuli and masks for the perceptual identification routines must be in the form of bit images. A bit image is a collection of bits in memory that represent the pixels of a graphic image on a one-to-one basis. Because of the unique way in which the Macintosh handles text and graphics, anything that can be displayed on the screen, including text, can be placed into a bit image. In `MS-BASIC`, bit images are created with the `GET` statement, which places the bit image into a numerical array. The `GET` statement is the easiest way to create a bit image of a stimulus within BASIC. Once a bit image has been created, it may be displayed with BASIC's `PUT` statement or with one of the perceptual identification routines in `PIDLib`. The presentation routines in `PIDLib` require that the width of a bit image be a multiple of 16 pixels. For example, a bit image with an upper left coordinate of (20,25) and a lower right coordinate of (35,45) is 16 pixels wide [$16 = (35 - 20) + 1$].

Graphic stimuli on the Macintosh may be prepared in many ways, including commercially available digitizers or graphics editors such as `SuperPaint` or `MacDraw`. Stimuli created in another application can be moved into BASIC via the clipboard and the Scrapbook. This technique is rather complicated but sometimes necessary. A more detailed description of how images are transferred into `MS-BASIC` from other applications can be found in Brooks (1985).

Masks

The first step in generating a mask is to determine which pixels will constitute the mask. If pixels in a bit image are thought of as being numbered from left to right, top to bottom, then numbers can be assigned to the pixels that are part of the mask. The pixels that constitute the mask are designated by placing the corresponding pixel numbers in an integer array.

The `PIDLib` routines `Assign`, `Shuffle`,¹ `ClaimPixels`, and `CreateMask` provide a way to create a random-dot mask. The `Assign` routine generates a series of integers and places them into an array. If a mask of 80 pixels is desired, then 80 elements of the array should be assigned values. `Shuffle` (Lane & Ashby, 1987) shuffles the array and `ClaimPixels` claims the pixels to be in the mask by reassigning the appropriate numbers to the elements of the shuffled array. `Shuffle` should be called again before stimulus clarification or materialization to randomize the order of the pixel numbers contained in the array.

The second method of creating a bit image of a mask results in a reduced mask that contains only the pixels common to the mask and the stimulus. Once again, the routines `Assign`, `Shuffle`, and `ClaimPixels` are used to generate a random assortment of pixels that make up the mask. A reduced mask may then be created with the routine `CreateRedMask`. If the resulting mask is combined with the stimulus using an exclusive-OR operation then only some pixels of the stimulus would be black and no extraneous pixels would appear, yielding images similar to those in Figure 2. Thus, as a result of the exclusive-OR operation, some of the black pixels of the stimulus are changed to white.

Superimposition

Next, the bit image of the mask may be superimposed over the bit image of the stimulus. One method of superimposition requires the use of the logical operator `OR`. Although it is possible to `OR` two arrays with a `FOR-NEXT` loop in BASIC, it is time consuming: To `OR` a 5,000-element array takes about 17 sec. The `PIDLib` routine called `BlendOR` serves the same function but is much faster: To `OR` a 5,000-element array takes less than 0.2 sec. The `BlendOR` routine returns the bit image of the resulting degraded stimulus in an array. An example of the result of such an operation is provided in Figure 3A. Similarly, a logical exclusive-OR (`XOR`) may be per-

Figure 3. Panel 3A illustrates a stimulus that has been combined with a mask using a logical-OR operation. Panel 3B illustrates the same stimulus combined with a mask using an exclusive-OR operation.

formed with equal speed on two arrays with the routine BlendXOR to obtain a degraded stimulus, as shown in Figure 3B, in which some of the black pixels of the stimulus have been turned white. The BlendOR and BlendXOR routines may be used to combine any two integer arrays.

After a mask and a stimulus have been combined, the routine DefineMask should be used to determine which pixels are actually black in the bit image of the mask. The numbers of the black pixels are placed in another integer array. The number of black pixels in the mask is also provided by this routine. The purpose of DefineMask is to allow the Clarify routine, which relies on an iterative process, to function smoothly and rapidly.

PERCEPTUAL IDENTIFICATION

Stimulus Clarification

Stimulus clarification through the stepwise removal of a mask is accomplished with the PIDLib routine called Clarify. This routine allows the specification of the rate and order of removal of the pixels in the mask. The pixels may be removed at any rate that is a multiple of 16.63 msec, the rate at which the Macintosh screen is refreshed. The Clarify routine removes pixels from the mask until the mask disappears or until the subject makes a keyboard response. This routine removes masks that have been combined with stimuli using either BlendOR or BlendXOR. Alternatively, the Clarify routine may be embedded in a FOR-NEXT loop and pixel removal may be paced by the subject or the experimenter.

The Clarify routine returns, in an integer array, the keyboard response and the amount of time elapsed since the first degraded image was displayed. Either of these measures could serve as a dependent variable.

Stimulus Materialization

Displaying the stimulus on the screen pixel by pixel in an incremental fashion (stimulus materialization) is also

accomplished with the Clarify routine. The factor that determines whether a stimulus is materialized or clarified is the manner in which the mask was created. For stimulus materialization, the mask must be created with the CreateRedMask routine.

Demonstration Experiment

A demonstration experiment was conducted in which 16 subjects read aloud a list of 48 words. Each word was presented for 1,663 msec with a 2,000-msec interval between successive words. The identification phase consisted of 96 words, half of which had been presented previously and half of which had not. Half of the new words and half of the old words were degraded with the stimulus clarification procedure. The remainder of the words were degraded with the stimulus materialization procedure. Therefore, 48 words were degraded under each procedure. As expected, prior exposure greatly facilitated later identification of the words [$t(15) = 5.57, p < .0001$]. For stimulus materialization, subjects required 7,393 msec to identify the new words and 6,856 msec to identify the old words. The identification latencies were slightly longer for the stimulus clarification task: 9,300 msec for new words and 9,074 msec for old words.

SAMPLE PROGRAMS

The sample program in Listing A illustrates the use of stimulus clarification. In this program a 1536-pixel mask is superimposed over a 1536-pixel bit image of a word. First, the LIBRARY statement is used so that the routines in PIDLib can be called. Pixels are then randomly selected so that 75% of the pixels in the mask are black. CreateMask is used to create the desired bit image of the mask, which is then superimposed over the bit image of the word with BlendXOR. Finally, the stimulus is clarified with the Clarify routine at the rate of 1 pixel per 16.63 msec.

A program that uses stimulus materialization is provided in Listing B. In this program the stimulus is once again the 1563-pixel bit image of a word, but the mask is created with CreateRedMask. The Clarify routine places one pixel of the stimulus at a time on the screen at the rate of 1 pixel per 99.78 msec.

The PIDLib routine called DefineMask determines the numbers of the black pixels in the mask and places them into an integer array. The number of pixels in the mask is placed into the variable actual%. The value of actual% determines how many pixels will be removed from the mask. Therefore, if actual% contains the number of pixels in the mask, the mask will be removed entirely as a result of the Clarify routine. If, on the other hand, the value of actual% is less than the number of pixels in the mask, the mask will not be removed completely.

In both programs, the information that is returned in the array record% is equivalent: The key that was pressed and the amount of time elapsed since the routine began its presentation. Both of the sample programs create the bit image of the word for illustrative purposes. Normally,

LISTING A (Continued)

```

'Superimposing the mask on the stimulus. The result is returned
'in degrade%

BlendXOR! 500,maskImage%(1),stimImage%(1),degrade%(1)

'Defining the mask

actual%=0                'all variables must be defined before using

DefineMask! pixInfo%(1),maskImage%(1),Mdef%(1),numpix%,actual%

'now Mdef% contains the `numbers of the black pixels in the mask

'Waiting for key press to begin
LOCATE 10,20 : PRINT "Hit any key to begin"
z$=INKEY$ : WHILE z$="" : z$=INKEY$ : WEND

'Removing the mask

mode%=1                  'mode%=1 for BlendXOR
                        'mode%=1 for BlendOR

rate%=1                  'rate of pixel removal = 1 pixel / 60th sec.
rec%(1)=1                'stop clarification after 1 keypress

x%=200 : y%=200          'coordinates of the image on the screen

Clarity! rec%(1),mode%,x%,y%,rate%,maskImage%(1),Mdef%(1),degrade%(1),actual%

```

LISTING B

```

LIBRARY "PIDLib"
OPTION BASE 1

numpix%=1536              'the number of pixels in the bit images

DIM pixInfo%(numpix%),maskImage%(500),stimImage%(500)
DIM degrade%(500),rec%(5)

'75% of the pixels will be black
black%=numpix% * .75
DIM Mdef%(black%)

Assign! pixInfo%(1),black%

'randomizing the order with the Shuffle routine (Lane & Ashby, 1986)

Shuffle! numpix%,pixInfo%(1)

'reclaiming the pixels that are black

ClaimPixels! pixInfo%(1),numpix%

'randomizing the order for the Clarity routine

Shuffle! numpix%,pixInfo%(1)

```

LISTING B (Continued)

```

'Setting up the bit images

    CLS
    GET (10,10)-(105,52),maskImage%

    MOVETO (14,30) : PRINT "Ebbinghaus"
    GET (10,10)-(105,52),stimImage%
    CLS

'Creating the mask

    CreateRedMask! pixInfo%(1),maskImage%(1),stimImage%(1),numpix%

'Superimposing the mask on the stimulus. The result is returned
'in degrade%

    BlendXOR! 500,maskImage%(1),stimImage%(1),degrade%(1)

'Defining the mask

actual%=0                                'all variables must be defined before using

DefineMask! pixInfo%(1),maskImage%(1),Mdef%(1),numpix%,actual%

'now Mdef% contains the numbers of the black pixels in the mask

'Waiting for key press to begin
    LOCATE 10,20 : PRINT "Hit any key to begin"
    z$=INKEY$ : WHILE z$="" : z$=INKEY$ : WEND

'Removing the mask

mode%=1                                'mode%=1 for BlendXOR
                                        'mode%=1 for BlendOR

rate%=6                                'rate of pixel removal = 1 pixels each
                                        '6/60th sec.
rec%(1)=1                              'stop clarification after 1 keypress

x%=200 : y%=200                        'coordinates of the image on the screen

Clarify! rec%(1),mode%,x%,y%,rate%,maskImage%(1),Mdef%(1),degrade%(1),actual%

```

APPENDIX A

GENERAL NOTES:

A variable must be defined before it is passed to a routine. The exclamation point should follow the names of all routines. Be sure to pay close attention to the types of the variables.

If the argument is not an array, the value does not have to be placed in a variable. For example, if `n%=10` then the following two statements produce equivalent results:

```
Assign! array%(1),n%
```

APPENDIX A (Continued)

Assign! array%(1),10

Whenever an argument is an array, the element of the array that is passed determines the starting point of the operations. For most purposes, the first element of the array should be passed to the routine.

Assign! array%(1),n%

This statement places a series of integers from 1 to n% in array%. It is equivalent to, and much faster than, the following MS-BASIC statements:

FOR i=1 to n% : array%(i)=i : **NEXT** i

BlendOR! size%,maskImage%(1),stimulusImage%(1),degradedImage%(1)

size% is the number of elements in the three arrays. This routine performs a logical or using the arrays maskImage% and stimulusImage% and places the result in the array degradedImage%. If size% is equal to the size of the arrays and the first element of each array is passed to *BlendOR* then all elements of the arrays will be blended. If only maskImage%(10) through maskImage%(20) are to be blended with stimulusImage%(1) through stimulusImage%(10), then the command would read as follows:

BlendOR! 10,maskImage%(10),stimulusImage%(1),degradedImage%(1)

BlendXOR! size%,maskImage%(1),stimulusImage%(1),degradedImage%(1)

This routine is the same as BlendOR except that it performs a logical exclusive-or on the two arrays.

ClaimPixels! pixelInfo%(1),numelements%

This routine "reclaims" pixels that have been shuffled in the array pixelInfo%. This is equivalent to the following BASIC statements:

FOR i=1 to numelements%

IF pixelInfo%(i) < > 0 **THEN** pixelInfo%(i) = i

NEXT i

Clarify!

rec%(1),mode%,x%,y%,rate%,Image1%(1),Def%(1),Image2%(1),actual%

This routine is best explained by the arguments it takes:

rec%(1) - the maximum number of responses that can occur. The value of

APPENDIX A (Continued)

this element must be set to a nonzero value before Clarify is called.

For a typical perceptual identification experiment, `rec%(1)` should be set to 1. If `rec%(1)` is greater than 1 then `rec%(2)` through `rec%(5)` are repeated for each response. Note that the routine returns the values of `rec%(2)` through `rec%(5)`.

`rec%(2)` - the type of response that occurred.

0 - null

1 - mouse was pressed down

3 - key press

`rec%(3)` - the elapsed time in 60th's of a second

`rec%(4)` - if a mouse click occurred, this is the x-coordinate of the cursor. If a key was pressed, then the ASCII code is returned

`rec%(5)` - if the response was a mouse click, then this element contains the y-coordinate of the cursor.

`mode%` - determines the manner of pixel removal. `Mode%` should equal 1 for images that were blended with *BlendXOR* or 0 for images that were created with *BlendOR*.

`x%`, `y%` - the coordinate at which the upper left corner of the bit image will be displayed.

`rate%` - the rate of pixel removal or addition in screen refreshes (60.13 Hz). If `rate%` equals 1 then 1 pixel is removed every 16.63 ms. If `rate%` equals 3 then 1 pixel is removed every 49.89 ms.

`Image1%(1)` - the first element of the bit image of the mask that was blended with the bit image of the stimulus. If `mode%` equals 0, then `Image1%(1)` should be the first element of the bit image of the stimulus.

`Def%(1)` - the values in this array were returned from the *DefineMask* routine. `Def%` contains the numbers of the pixels in the mask.

`Image2%(1)` - the first element of the bit image of the degraded stimulus.

`actual%` - contains the number of pixels that will be removed from the mask if the subject makes no response.

`CreateMask!` `pixInfo%(1)`, `maskImage%(1)`, `numpix%`

`pixinfo%` is the array containing the numbers of the pixels that will be black

APPENDIX A (Continued)

in the bit image of the mask (MaskImage%). numPix% is the number of elements in pixInfo%.

CreateRedMask! pixInfo%(1),MaskImage%(1),StimImage%(1),numpix%

This routine is similar to CreateMask except that it creates a mask containing only those pixels common to both the mask and the stimulus. MaskImage%(1) and StimImage%(1) are the bit images of the mask and stimulus, respectively.

DefineMask! pixInfo%(1), MaskImage%(1),MDef%(1),numelem%,actual%

The numbers of the black pixels in the mask are contained in pixInfo%.

The bit image of the mask is in MaskImage%. Mdef% is an array that will contain a compressed version of pixInfo%. numelem% is the number of elements in pixInfo%. The variable actual% will contain the number of black pixels in the mask.

Shuffle! n%,array%(1)

This routine shuffles the first n% elements of array% beginning with array%(n). For example, if elements array%(10) through array%(20) are to be shuffled, then the statement would read Shuffle! 10,array%(10).

APPENDIX B

Assign		00 04 4E AD	00 2A 0C 40
00 00 00 01	4E AD 00 2A	00 03 66 2E	D5 FC 00 00
0C 40 00 03	66 30 26 4A	00 04 3A 13	34 14 BB 42
4E AD 00 2A	08 80 00 0F	34 82 D7 FC	00 00 00 02
0C 40 00 03	66 20 3C 12	D9 FC 00 00	00 02 D5 FC
34 06 53 42	D6 C2 D6 C2	00 00 00 02	53 46 0C 46
60 0C 3A 06	52 45 36 85	00 00 67 02	60 DC 70 00
97 FC 00 00	00 02 51 CE	4E 75 74 0D	70 00 4E AD
FF F2 70 00	4E 75 74 0D	00 42	
70 00 4E AD	00 42		
BlendOR		ClaimPixels	
00 00 00 01	4E AD 00 2A	00 08 00 00	4E AD 00 2A
08 80 00 0F	0C 40 00 03	0C 40 00 03	66 30 26 4A
66 60 3C 12	55 46 4E AD	4E AD 00 2A	08 80 00 0F
00 2A 0C 40	00 03 66 52	0C 40 00 03	66 20 3C 12
26 4A D7 FC	00 00 00 04	60 14 3A 06	52 45 38 13
4E AD 00 2A	0C 40 00 03	0C 44 00 00	67 02 36 85
66 40 28 4A	D9 FC 00 00	D7 FC 00 00	00 02 51 CE
00 04 4E AD	00 2A 0C 40	FF EA 70 00	4E 75 74 0D
00 03 66 2E	D5 FC 00 00	70 00 4E AD	00 42
00 04 3A 13	34 14 84 45		
34 82 D7 FC	00 00 00 02	Clarify	
D9 FC 00 00	00 02 D5 FC	00 00 00 01	4E 53 FF DC
00 00 00 02	53 46 0C 46	27 4F FF E6	43 FA 02 98
00 00 67 02	60 DC 70 00	32 BC 00 00	43 FA 02 7C
4E 75 74 0D	70 00 4E AD	72 00 49 FA	02 7A 4E AD
00 42		00 2A 0C 40	00 03 66 00
		02 5C 2C 4A	27 4E FF EA
		27 4E FF DE	45 FA 02 76
		34 9E 4E AD	00 2A 08 80
		00 0F 0C 40	00 03 66 00
		02 3C 37 52	FF DC 4E AD
		00 2A 08 80	00 0F 0C 40
		00 03 66 00	02 28 33 52
		00 02 4E AD	00 2A 08 80
		00 0F 0C 40	00 03 66 00
		02 14 0C 40	00 00 66 0A
BlendXOR			
00 00 00 01	4E AD 00 2A		
08 80 00 0F	0C 40 00 03		
66 60 3C 12	55 46 4E AD		
00 2A 0C 40	00 03 66 52		
26 4A D7 FC	00 00 00 04		
4E AD 00 2A	0C 40 00 03		
66 40 28 4A	D9 FC 00 00		

APPENDIX B (Continued)

```

24 3C 00 00      00 25 4E FA      FF F8 34 03      C4 FC 00 02
02 04 32 92      48 7A 02 0C      D5 C2 42 82      34 12 53 42
A8 70 42 80      42 82 30 3A      84 FC 00 08      38 02 48 42
02 02 53 40      C0 FC 00 40      42 80 30 3C      00 07 90 82
34 29 00 02      84 FC 00 08      3C 00 42 80      2C 6B FF FC
D0 42 D0 B8      08 24 08 80      DD C4 10 16      0D C0 1C 80
00 00 27 40      FF E2 4E AD      51 CB FF C6      4E 5B 70 00
00 2A 08 80      00 0F 0C 40      4E 75 34 3C      00 0D 70 00
00 03 66 00      01 C8 37 52      4E AD 00 42
FF FE 4E AD      00 2A 0C 40
00 03 66 00      01 B8 27 4A
FF F2 4E AD      00 2A 0C 40
00 03 66 00      01 A8 27 4A
FF F6 4E AD      00 2A 0C 40
00 03 66 00      01 98 27 4A
FF FA 4E AD      00 2A 0C 40
00 03 66 00      01 88 36 12
54 AB FF EA      24 7C 00 00
01 6A 72 00      74 00 78 00
20 38 01 6A      B0 B8 01 6A
67 FA 41 FA      01 92 20 B8
01 6A 4A 46      4E 71 20 12
B0 92 67 FC      60 10 20 6B
FF E2 38 2B      FF FE 22 6B
FF FA 61 38      66 04 51 CB
FF EE 2C 6B      FF DE DD FC
00 00 00 02      36 3A 01 58
3C C3 60 12      0C 56 00 03
67 06 48 6E      00 04 A8 71
DD FC 00 00      00 08 51 CB
FF EC 2E 6B      FF E6 4E 5B
70 00 4E 75      48 E7 A2 02
42 86 42 82      42 80 34 03
C4 FC 00 02      2C 6B FF F6
DD C2 42 82      34 16 0C 42
00 00 67 4A      53 42 84 FC
00 08 3C 02      58 46 48 42
70 07 90 82      42 82 2C 6B
FF F2 DD C6      34 2B FF DC
0C 42 00 00      67 16 42 82
14 16 01 02      67 20 2C 6B
FF FA DD C6      14 16 01 42
1C 82 60 12      14 16 01 02
66 0C 2C 6B      FF FA DD C6
14 16 01 82      1C 82 4C DF
40 45 2C 6B      FF EA 32 19
83 FC 00 10      34 19 60 14
48 E7 40 80      60 02 30 D9
51 C9 FF FC      4C DF 01 02
D0 FC 00 40      51 CA FF EA
2A 12 DA 84      BA 92 66 04
70 00 4E 75      42 67 3F 3C
00 0A 2F 0C      A9 70 30 1F
67 EA 2E 2C      00 06 0C 6C
00 01 00 00      67 0A 0C 6C
00 03 00 00      67 14 60 D4
3C FC 00 01      20 07 90 BA
00 6E 3C C0      2C EC 00 0A
60 22 3C FC      00 03 20 07
90 BA 00 5C      3C C0 1C BC
00 00 1D 6C      00 05 00 01
DD FC 00 00      00 02 3C FC
00 00 4E 71      30 3A 00 38
52 40 41 FA      00 32 30 80
B0 7A 00 32      66 8E 30 3C
00 01 4E 75      34 3C 00 0D
70 00 2E 6B      FF E6 4E AD
00 42 00 00      00 00 00 00
00 00 00 00      00 00 00 00
00 00 00 00      00 00 00 00
00 00 00 00      00 00 00 00
00 00      00 00 00 00

CreateMask
00 00 00 01      4E 53 FF F8
4E AD 00 2A      0C 40 00 03
66 00 00 70      27 4A FF F8
4E AD 00 2A      0C 40 00 03
66 00 00 60      D5 FC 00 00
00 04 27 4A      FF FC 4E AD
00 2A 0C 40      00 03 66 00
00 4A 42 83      4E AD 00 2A
42 86 42 82      36 12 60 38
42 84 24 6B      42 84 24 6B

CreateRedMask
00 00 00 01      4E 53 FF F4
4E AD 00 2A      0C 40 00 03
66 00 00 94      27 4A FF F8
4E AD 00 2A      0C 40 00 03
66 00 00 84      D5 FC 00 00
00 04 27 4A      FF FC 4E AD
00 2A 0C 40      00 03 66 00
00 6E D5 FC      00 00 00 04
27 4A FF F4      4E AD 00 2A
0C 40 00 03      66 00 00 58
42 83 36 12      60 46 42 86
42 82 42 84      24 6B FF F8
34 03 C4 FC      00 02 D5 C2
42 82 34 12      53 42 84 FC
00 08 38 02      48 42 42 80
30 3C 00 07      90 82 3C 00
42 80 2C 6B      FF F4 DD C4
10 16 0D 00      67 0E 42 80
2C 6B FF FC      DD C4 10 16
0D C0 1C 80      51 CB FF B8
4E 5B 70 00      4E 75 34 3C
00 0D 70 00      4E AD 00 42

DefineMask
00 00 00 01      4E 53 FF F8
4E AD 00 2A      0C 40 00 03
66 00 00 9E      27 4A FF F8
4E AD 00 2A      0C 40 00 03
66 00 00 8E      D5 FC 00 00
00 04 27 4A      FF FC 4E AD
00 2A 0C 40      00 03 66 00
00 78 28 4A      4E AD 00 2A
08 80 00 0F      0C 40 00 03
66 00 00 66      42 83 36 12
42 81 60 42      42 86 42 82
42 84 24 6B      FF F8 34 03
C4 FC 00 02      D5 C2 42 82
34 12 38 92      53 42 84 FC
00 08 38 02      48 42 42 80
30 3C 00 07      90 82 3C 00
42 80 2C 6B      FF FC DD C4
10 16 0D 00      67 08 D9 FC
00 00 00 02      52 41 51 CB
FF BC 36 01      4E AD 00 2A
0C 40 00 03      66 00 00 0A
34 83 4E 5B      70 00 4E 75
34 3C 00 0D      70 00 4E AD
00 42

LibInit
00 00 00 01      42 68 00 06
70 00 4E 75

Shuffle
00 08 00 00      20 2D FF 7E
0C 80 00 00      00 01 66 06
2B 78 01 6A      FF 7E 4E AD
00 2A 08 80      00 0F 0C 40
00 03 66 00      00 4C 38 12
4E AD 00 2A      08 00 00 0F
66 4A 0C 40      00 03 66 38
36 04 53 43      60 1C 4E BA
00 22 53 40      D0 40 53 44
32 04 D2 41      34 32 00 00
35 B2 10 00      00 00 35 82
10 00 51 CB      FF E2 70 00
4E 75 55 8F      A8 61 30 1F
C0 C4 48 40      52 40 4E 75
24 3C 00 00      00 0D 70 00
4E AD 00 42      74 05 70 00
4E AD 00 42

```