

# **MysteryTwister C3**

THE CRYPTO CHALLENGE CONTEST

## **MUSIC CODE "VIER, NEUN, FÜNF, EINS, DREI, ZWEI, ACHT" - PART 2**

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May 2011

# Introduction to the Music Code

## Monoalphabetic substitution and transposition

In 1929 the French composer Francis Poulenc composed the piece „Pièce brève sur le nom d' Albert Roussel“. By assigning notes to every letter of the alphabet (except the Y and the Z), Poulenc was able to transform the name of his musician colleague Albert Roussel to notes and with this to set it to music.

But Poulenc was not the first to experiment with music codes. Before him other famous musicians and academics already developed methods to encrypt secret messages with music (della Porta, Debussy, Ravel).

# Introductory Example

## MTC3-Jingle

What follows is a more advanced substitution technique:

	C	C#	D	D#	E	F	F#	G	G#	A	Bb	B
1	P	I	7	M	0	8	U	2	O	H	5	A
2	Q	T	C	S	R	W	9	V	4	E	Z	K
3	N	D	1	X	L	3	B	J	Y	6	F	G


In the first row, the 12 notes of the chromatic scale are listed. In the left column are the 3 groups representing the duration.

To place the note into the right group (1, 2 or 3) the duration until the next note is essential. This means that within this duration even the rests have to be considered. For the last note of the piece, the duration until the double bar line is the determining factor.

1. group: less than a quarter beat ( i.e. an eighth note, a dotted-eighth note, a sixteenth note, a sixteenth note + a sixteenth rest, etc.)
2. group: the duration is between a quarter beat and less than two quarter beats (i.e. a quarter note, a dotted-quarter note, a quarter note + an eighth rest, etc.)
3. group: two quarter notes or more ( i.e. a half note, a whole note, a quarter note + a half rest, etc.)

## Example

(CT: Cipher Text, PT: Plain Text)



The image shows a musical staff in 4/4 time with a key signature of one flat (Bb). The notes and rests are: Bb1 (quarter), D#2 (quarter), a quarter rest, C#1 (quarter), C3 (quarter), a quarter rest, C3 (quarter), and A2 (quarter). The notes are grouped into pairs: (Bb1, D#2), (C#1, C3), (C3, A2). The rests are placed between the notes of each pair.

CT:	Bb1	D#2	C#1	C3	C3	A2
PT:	5	S	I	N	N	E

If, for example, an eighth rest follows on an eighth note, those will be added, so that now we have a duration of one quarter beat. This combined value of note and rest will then be placed into group 2 (see the ciphertext D#2 above).

Using the table from above we encrypt the (German) sentence:

AUCH DER TUECHTIGE BRAUCHT GLUECK  
(means: even the brave needs luck)

This encrypts with the substitution to:

B1, F#1, D2, A1, C#3, A2, E2, C#2, F#1, A2, D2, A1, C#2,  
C#1, B3, A2, F#3, E2, B1, F#1, D2, A1, C#2, B3, E3, F#1, A2,  
D2, B2

And now for the transposition:

As key for the transposition we use an arbitrary note sequence:  $g' - f' - c' - bb' - a' - c''$ . Each of this six notes generates a column. Next, the cipher text symbols are written into the columns.

$g'$	$f'$	$c'$	$bb'$	$a'$	$c''$
B1	F#1	D2	A1	C#3	A2
E2	C#2	F#1	A2	D2	A1
C#2	C#1	B3	A2	F#3	E2
B1	F#1	D2	A1	C#2	B3
E3	F#1	A2	D2	B2	D#3

Because the text only consists of 29 symbols, one symbol (X: encrypted D#3) is added to complete the matrix.

Now the notes of the key melody are sorted according to their tone pitch and like this the columns are interchanged. The lowest note (c') is placed at the first position and the highest note (c'') at the last. This leads to the following matrix:

c'	f'	g'	a'	bb'	c''
D2	F#1	B1	C#3	A1	A2
F#1	C#2	E2	D2	A2	A1
B3	C#1	C#2	F#3	A2	E2
D2	F#1	B1	C#2	A1	B3
A2	F#1	E3	B2	D2	D#3

The next step is to transfer the symbols onto paper in music notation:

The note sequence  $g' - f' - c' - bb' - a' - c''$ , which is our key, is used as intro of the piece.

The cipher text is read out column-wise from the matrix and forms the theme of the piece. The encrypter can decide in what octave the notes are notated. Furthermore, he has some leeway concerning what note value he chooses within the relevant group (1-3) and how he will potentially combine the note values and rest values. To get to the result from the additional file *MTC3-Jingle.mp3*, the harmonic context decides, if, for example, a F# is noted as F# or as Gb (see additional file *little\_lesson.pdf*, enharmonic equivalents).



## MTC3 - Jingle

(Henning Wolter)

**Intro**

B $\flat$ maj7      B $\flat$ maj7    E $\flat$ maj7      (drums enters)

g'    f'    c'    b $\flat$ '    a'    c''

**Theme**

6      Em7                                  Bm7                                  Em7                                  A      A

D2 F#1 B3                                  D2                                  A2 F#1 C#2 C#1    F#1 F#1 B1 E2    C#2    B1 E3

10      F#m7      Gmaj7                                  F#m7      Gmaj7                                  Em7                                  Gmaj7      F#m7      G/A

C#3    D2    F#3                                  C#2    B2                                  A1    A2                                  A2                                  A1 D2                                  A2    A1    E2    B3

14                                  B7(b9)

D#3

# The Challenge

## Vier, Neun, Fünf, Eins, Drei, Zwei, Acht

**Remark:** To solve this challenge you first have to solve the level 1 challenge *Music Code "Vier, Neun, Fünf, Eins, Drei, Zwei, Acht" - Part 1*.

Listen to the composition „Vier, Neun, Fünf, Eins, Drei, Zwei, Acht“ (*VierNeunFünfEinsDreiZweiAcht.mp3*) and have a look at the corresponding notes (*VierNeunFünfEinsDreiZweiAcht.pdf*).

According to the substitution method from above different notes were assigned to the numbers 0-9 and the 26 letters of the alphabet (overall 36 plaintext symbols).

(The arrangement of the symbols in the substitution table differs from the one used for the example MTC3-Jingle.)

# The Challenge

Use your solution from part 1 of this challenge. So you only have to solve the substitution part.

Extract the message, which is hidden in the given guitar melody.

The solution is the sixth word of this message. Please give it in capital letters.

## Hints:

The message is a German poem by a German author. At the end of the message the surname (5 symbols) and the year of birth (4 symbols) of the author are given and overall you have 105 plain text symbols.