CORRESPONDENCE OF HUYGENS REGARDING GAMES OF CHANCE

EXTRACTED FROM VOLUME V
OF THE
OEUVRES COMPLÈTES
OF
CHRISTIAAN HUYGENS

No. 1468[1]

B. Frenicle de Bessy to Christiaan Huygens
[September 1665]
Appendix to No. 1467, a Letter from M. Thevenot to Chr. Huygens, 18 September.

A & B play at + & at tails to such condition that the one who brings forth + takes all that which is in the game & the one who brings forth tails puts one écu into the game. One demands what is the disadvantage of A, who plays first.[2]

This question is not easily determined, because as there are half of the coups which can be played, in which the last brings forth tails & must put an écu into the game, it is necessary to know, that which one must make of that which is in the game, when there remains something, when one wishes to quit, because it can arrive that one could always bring forth tails & that they can not be able to finish, one could be in succession forced to quit.

Now one can make two choices of the remainder in case that there is of it; the most just would be to divide it, & in this case the disadvantage of the 1st can never ascend to 10 sols, namely to $\frac{1}{6}$ of that which one puts into the game; but if one continues to play a long time, it approaches more nearly any given quantity that it be; because his disadvantage increases in continuing to play. Here is the way to find how much the disadvantage is less than $\frac{1}{6}$. double the number of coups that each one must play, & adding 1 to the double; take the power of 2 of which this sum is exponent, the triple of this power is the denominator of the fraction, & the numerator is 1. Thus in order to know how much the disadvantage of A will be less than $\frac{1}{6}$ if one plays only 3 coups in sequence; I take the double plus 1 of 3. which is 7. the 7th power of 2 or 128. of which the triple is 384. I say that the disadvantage of A will be $\frac{1}{6}$ less $\frac{1}{384}$. If A & B play each only 3 coups.

Date: February 8, 2009.
Translated by Richard J. Pulskamp, Department of Mathematics and Computer Science, Xavier University, Cincinnati, OH..

[1]T. V. page 489-450.

[2]This is the question sent by Chr. Huygens to J. Hudde 4 April 1665. See Letter No. 1403.

Alternately in order to know what is this disadvantage without speaking of the lixidue[?];[3] take the power of 2. as before & this will be the denominator of the fraction, divide this same power by 6. rejecting the 2, which one has always for remainder, the quotient will be the numerator. Thus supposing that one plays each 4. coups; the double $+1$. of 4. is 9. which is the exponent of 512. which being divided by 6. gives 85. one will have therefore $\frac{85}{512}$ of écu for the disadvantage of A. & thus of the others.

But if one wishes no point that the rest be divided, but that each one retakes the portion which he will have set of that which remains, the disadvantage of A will become double of that which he had in the other case, namely when one shared the rest; & thus playing 4. coups in sequence his disadvantage will be $\frac{85}{256}$ instead of $\frac{85}{512}$. & thus of the others.

These disadvantages make together a proportion which can be continued to infinity. in a manner that having the disadvantage of A, when one plays only one coup, which is $\frac{1}{8}$. the others are found multiplying by 4. the 2. terms of this fraction and adding 1. to the Numerator. One will have therefore $\frac{1}{8}$ for 1. coup | $\frac{5}{32}$ for 2. | $\frac{21}{128}$ for 3. | $\frac{85}{512}$ for 4. | $\frac{341}{2048}$ for 5. &c.

For

MR. HUYGENS

[3]*Translator's note*: The editor apparently could not decipher the word in the manuscript. Nonetheless it must refer to the adjustment of $\frac{1}{6}$. This paragraph simply shows how to compute the disadvantage given in the previous paragraph directly.