

DE  
TONIS COMBINATIONIS,  
DISSERTATIO PHYSICA;  
QUAM,  
CONSENSU AMPLISS. AD UNIVERS. ABOËNSEM  
FACULT. PHILOS.,  
PRÆSIDE  
M. GUST. GABR. HÄLLSTRÖM,

*Ordin. Imper. de St. Wladimiro in quarta classe Equite,  
Physices Prof. Publ. Ordin.,  
Reg. Acad. Scient. Stockholm. Membro,*

PRO GRADU PHILOSOPHICO

P. P.

ANDREAS GUST. SIMELIUS,  
*Ostrobotniensis,*

in Audit. Philos. die 5 Junii 1819,  
horis p. m. solit.

PARS II.

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ABOÆ, Typis FRENCKELLIANIS.

47.

THE HISTORY OF THE

REIGN OF

CHARLES THE FIRST

BY

JOHN BURNET

OF

SCOTLAND

IN

SEVEN VOLUMES

THE SECOND

VOLUME

LONDON

Toni sonantes	Horologium ostendebat	Tempus præter- lapsum	Toni sonantes	Horologium ostendebat	Tempus præter- lapsum
<u>E &amp; F</u>	32'. 33". 28'''.		<u>Fis &amp; G</u>	33'. 32". 21'''.	
	35. 23.	1". 55'''.		35. 27.	2". 66'''.
(10 pulsus simplices numerati).	37. 19.	56.	(10 pulsus duplices numerati)	38. 27.	60.
	39. 12.	53.		41. 30.	63.
	41. 4.	52.		44. 22.	52.
	42. 59.	55.		47. 14.	52.
	44. 57.	58.		50. 12.	58.
	46. 55.	58.		53. 4.	52.
	48. 51.	56.		55. 57.	53.
	50. 47.	56.		58. 53.	56.
	52. 41.	54.		34. 1. 52.	59.
Medium	10 puls. simpl. 1 puls. simpl.	1". 55". 3. 0. 11. 53.	Medium	10 puls. dupl. 1 puls. simpl.	2. 57. 1. 0. 8. 86.
<u>F &amp; Fis</u>	32'. 52". 41'''.		<u>G &amp; Gis</u>	34'. 1" 52'''.	
	56. 44.	3". 63'''.		5. 56.	4". 4'''.
(10 pulsus duplices numerati).	33. 0. 35.	51.	(10 pulsus duplices numerati).	10. 1.	5.
	4. 25.	50.		14. 7.	6.
	8. 27.	61.		18. 11.	4.
	12. 29.	62.		22. 14.	3.
	16. 26.	57.		26. 20.	6.
	20. 23.	57.		30. 24.	4.
	24. 29.	66.		34. 29.	5.
	28. 22.	53.		38. 29.	0.
	32. 21.	59.		42. 33.	4.
Medium	10 puls. dupl. 1 puls. simpl.	3. 58. 0. 0. 11. 9.	Medium	10 puls. dupl. 1 puls. simpl.	1". 4". 1. 0. 12. 21.

Toni sonantes	Horologium ostendebat	Tempus præter-lapsum	Toni sonantes	Horologium ostendebat	Tempus præter-lapsum
<u>Gis &amp; A</u>	37'. 41". 20'''		<u>B &amp; H</u>	39'. 55". 19'''	
(10 pulsus duplices numerati)	44. 32.	3". 12'''	(10 pulsus duplices numerati)	38. 19.	2". 60'''
	47. 43.	11.		41. 11.	52.
	50. 54.	11.		44. 3.	52.
	54. 8.	14.		46. 58.	55.
	57. 27.	19.		49. 59.	61.
	38. 0. 38.	11.		52. 56.	57.
	3. 55.	17.		55. 48.	52.
	7. 16.	21.		58. 51.	63.
	10. 36.	20.		40. 1. 51.	60.
	13. 55.	19.		4. 56.	65.
<u>Medium</u>	10 puls. dupl. 1 puls. simpl.	3". 15''' 5. 0. 9, 78.	<u>Medium</u>	10 puls. dupl. 1 puls. simpl.	2". 57''' 7. 0. 8, 89.
<u>A &amp; B</u>	38'. 36". 5'''		<u>H &amp; C</u>	40'. 46". 19'''	
(10 pulsus duplices numerati)	39. 8.	2". 63'''	(10 pulsus duplices numerati)	48. 21.	2". 2'''
	42. 4.	56.		50. 44.	23.
	44. 58.	54.		52. 55.	11.
	47. 53.	55.		55. 11.	16.
	50. 54.	61.		57. 30.	19.
	53. 46.	52.		59. 47.	17.
	56. 36.	50.		41. 2. 1.	14.
	59. 37.	61.		4. 25.	24.
	39. 2. 36.	59.		6. 46.	21.
	5. 40.	64.		9. 4.	18.
	8. 41.	61.			
	11. 44.	63.	<u>Medium</u>	10 puls. dupl.	2". 16''' 5.
	14. 50.	66.		1 puls. simpl.	0. 6, 83.
<u>Medium</u>	10 puls dupl. 1 puls simpl.	2". 58''' 8. 0. 8, 94.			

Pauca hinc deduxisse sufficiat consecutaria. Ex dato per observationes temporis spatio, inter duos pulsus successivos præterlapso, determinari potest pulsum temporis  $1''$  intervallo peractorum numerus, quo cum numero secundum vulgarem theoriam comparato apparet, mancam, in quibusdam saltem casibus, illam esse habendam. Ad illum vero computum requiritur, ut absolutus quemvis tonum gignens oscillationum numerus innotescat. Eum in finem usi sumus Tonometro a Chladni (\*) descripto, etiamsi neque ille satis magnam permittat præcisionem, quo toni C erimus numerum oscillationum circiter = 70.

Hoc vero cognito, positaque ratione  $\underline{C} : \underline{Cis} :: 1 : \frac{25}{24}$   
 (Marpurg (\*\*) & Chladni (†)), erit ex theoria tonus  
 combinatiois =  $\frac{1}{24} C$ , quum  $\frac{1}{24}$  numerorum  $\frac{24}{24}$  &  $\frac{25}{24}$   
 maximus sit communis divisor, unde apparet pulsum temporis  $1''$  spatio audiendorum numerum  
B 2 esse

(\*) *Akustik von E. F. F. Chladni. Leipz. 1802, p. 35.*

(\*\*) *Anfangsgründe der Theoretischen Musik, von Fr. Willh. Marpurg. Leipz. 1757, p. 29.*

(†) l. c. p. 27.

esse debere =  $\frac{70}{24} = 2,92$ . E ratione autem

$\underline{C} : \underline{Cis} :: 1 : \frac{256}{243}$  (*Kirnberger* (\*)), haberetur similiter tonus combinationis =  $\frac{1}{243} \underline{C}$ , seu pulsuum numerus =  $\frac{70}{243} = 0,29$ , qui secundum observationem revera =  $\frac{60}{17,71} = 3,78$ .

E ratione  $\underline{F} : \underline{Fis} :: \frac{4}{3} : \frac{45}{32} :: 1 : \frac{135}{128}$  (*Marpurg & Kirnberger*) oriretur ex citata theoria tonus combinationis =  $\frac{1}{128} \cdot \underline{F} = \frac{93,33}{128} = 0,73$ , qui esset numerus pulsuum spatio temporis 1'' audiendorum.

Similiter ratio  $\underline{F} : \underline{Fis} :: \frac{4}{3} : \frac{25}{18} :: 1 : \frac{25}{24}$  (*Marpurg & Chladni*) præbere deberet tonum combinationis =  $\frac{1}{24} \cdot \underline{F} = \frac{93,33}{24} = 3,89 =$  numero pulsuum qui ex observatione erat =  $\frac{60}{11,95} = 5,02$ .

Ratio inter omnes conveniens Musicos  $\underline{B} : \underline{H} :: \frac{16}{9} : \frac{15}{8} :: 1 : \frac{135}{128}$  gignit tonum combinationis =  $\frac{1}{128} \cdot \underline{B}$

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(\*) *Anfangsgr. d. Naturlehre von J. T. Mayer, Götting. 1802, p. 153.*

$$= \frac{124,44}{128} = 0,97 = \text{numero pulsuum qui in hoc organo observabatur} = \frac{60}{8,89} = 6,79.$$

E ratione tandem  $\underline{\text{Gis}} : \underline{\text{A}} :: \frac{192}{125} : \frac{5}{3} :: 1 : \frac{625}{576}$   
 (*Marpurg*) oriretur tonus combinationis  $= \frac{1}{576} \cdot \underline{\text{Gis}}$   
 $= \frac{107,52}{576} = 0,19 = \text{numero pulsuum; e ratione}$   
 $\underline{\text{Gis}} : \underline{\text{A}} :: \frac{25}{16} : \frac{5}{3} :: 1 : \frac{16}{15}$  (*Chladni*) esset tonus combinationis  $= \frac{1}{15} \cdot \underline{\text{Gis}} = \frac{107,52}{15} = 7,17 = \text{numero pulsuum; atque tandem e ratione}$   
 $\underline{\text{Gis}} : \underline{\text{A}} :: \frac{128}{81} : \frac{270}{161} :: 1 : \frac{10935}{10304}$  (*Kirnberger*) haberetur tonus combinationis  $= \frac{1}{10305} \cdot \underline{\text{Gis}} = \frac{107,52}{10304} = 0,01 = \text{numero pulsuum, qui in observatione erat} = \frac{60}{9,78} = 6,13.$

Quod ipsum attinet tonum tertium, qui e consonantia duorum auditur tonorum, occurrunt etiam respectu illius phaenomena a vulgari theoria aberrantia, qualia sequentia praebent exempla. Ratio tonorum  $\bar{c} : \bar{gis} :: 1 : \frac{192}{195}$  (*Marpurg*) gigneret pulsus numero  $= 4,1$  spatio temporis  $1''$ ; ratio  $\bar{c} : \bar{gis} :: 1$

$\therefore 1 : \frac{128}{81}$  (*Kirnberger*) pulsus 6, 3; atque tandem  
 ratio  $\bar{c} : \bar{gis} :: 1 : \frac{25}{16}$  (*Chladni*) pulsus 32 seu tonum  
 tertium  $\bar{C}_2$ , cujus loco tonum combinationis *dis*  
 audivimus, nullis perceptis pulsibus, quomodocun-  
 que tonus  $\bar{gis}$  vel demitteretur parum vel eleva-  
 retur ad proportionem assequendam *Marpurgi* vel  
*Kirnbergeri*. Deinde simul sonantes toni  $\bar{c}$  &  $\bar{b}$ ,  
 quorum proportio communi Musicorum consensu  
 est  $1 : \frac{16}{9}$ , progignerent e theoria tonum combinatio-  
 nis  $\bar{B}_2$ , cujus non percepti loco auditur *gis*. Si-  
 militer e consonantia tonorum  $\bar{c}$  &  $\bar{b}$ , pro quibus  
 valet proportio  $1 : \frac{64}{45}$ , orientur secundum theo-  
 riam pulsus 28,5 seu tonus  $\bar{B}_1$ , quorum loco ex-  
 perientia tonum distincte audiendum præbet  $\bar{cis}$ .  
 Proportio  $\bar{dis} : \bar{g} :: 1 : \frac{32}{25}$  (*Marpurg & Chladni*)  
 suppeditaret ex theoria tonum  $\bar{G}_2$ , proportio vero  
 $1 : \frac{81}{64}$  (*Kirnberger*) tonum  $\bar{Dis}$ , cujus loco revera  
 auditur *e*. Ita quoque toni  $\bar{gis}$  &  $\bar{h}$  e propor-  
 tione  $1 : \frac{625}{512}$  (*Marpurg*) audiendos sisterent pulsus 3,



intervallo temporis  $1''$ , & ex proportione  $1 : \frac{1215}{1024}$   
 (*Kirnberger*) pulsus 1, 6, qui tonum revera gignunt  
 $e$ , quem etiam proportio  $1 : \frac{6}{5}$  (*Chladni*) requirit.  
 His addatur exemplis, quod duos interdum acriore  
 adhibita attentione simul audiverimus tonos com-  
 binationis, ut  $\bar{d}$  &  $\bar{a}$  e consonantia tonorum  $\overline{\overline{fis}}$  &  $\overline{\overline{d}}$ ,  
 quorum  $d$  cum vulgari convenit theoria.

Etiam si ex his omnibus concludendum non sit,  
 vulgarem tam pulsuum descriptorum quam tonorum  
 combinationis theoriam falsam esse, cum scilicet  
 fieri possit, ut spatio temporis  $1''$  pulsationes nu-  
 mero quoque 0,29, 0,73, 0,19, 0,01 &c. fiant, atque  
 toni gravissimi non facile percepti  $\underline{\underline{C}}$ ,  $\underline{\underline{B}}$ ,  $\underline{\underline{Dis}}$  &c.  
 sonent, quos vero ob frequentiores simul auditos  
 pulsus & tonos acutos fortiores non valemus nu-  
 merare vel sentire; ipsi tamen hi frequentiores  
 pulsus & toni combinationis acutiores, qui conti-  
 nuitatem quandam in serie tonorum, licet parva  
 quoque fiat variatio proportionis eorum, retinent,  
 quique e theoria hac explicari non possunt, per-  
 spicue ostendunt, aliam simul admitti debere ex-  
 plicationem, cujus jam faciamus periculum.

Sicut pulsus a duobus tonis quibusvis simul  
 sonantibus perceptibiles fiunt auribus, quam pri-  
 mum

mum oscillationes utriusque ita conveniunt, ut eodem temporis momento complete absolvantur; sic etiam similis oritur sensus, quoties utriusque oscillationes integræ cum parte æquali simul ita sunt factæ, ut eodem temporis momento absolutæ sint utriusque oscillationes numero  $f + \frac{h}{k}$  &  $g + \frac{h}{k}$ , existentibus  $f$  &  $g$  numeris integris atque  $\frac{h}{k}$  fractione proprie. Quoties igitur intervallo temporis 1<sup>''</sup> numerus oscillationum utcunque incompletarum unius corporis unitate vel alio numero integro superat numerum alterius, toties eodem hoc tempore auditur pulsus, qui sic pro numeris  $r$  &  $r + 1$  oscillationum unius minuti secundi fiet semel, pro  $r$  &  $r + 2$  bis, pro  $r$  &  $r + 3$  ter, &c. eodem hoc intervallo temporis 1<sup>''</sup>; unde concluditur numerum oscillationum  $r$  &  $s$  gignere pulsus numero  $s - r$ , qui, si celerius semet excipiant, tonum audiendum præbent combinationis. Temporis namque spatio, quo unus auditur pulsus, fient corporum sonantium oscillationes numero  $\frac{r}{s - r}$  &  $\frac{s}{s - r}$ , quorum numerorum differentia est  $\frac{s}{s - r} - \frac{r}{s - r} = 1$ .

Non quidem facile potest physice ostendi, quomodo fiat, ut pulsus allata hac ratione a coincidentia oscillationum etiam incompletarum audiantur,