

VITRUVIUS ON MODULE

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The reintroduction of modular coordination in modern architecture¹ revived the Vitruvian theory² on modular composition.

Vitruvius (1.2.2) teaches that "Order is a suitable disposition of members of a building and the coordination of modular sizes³ implying proportion for the single element and for the whole. It consists of dimensions, which are called *posotes* in Greek. Dimension itself is the determination of modules⁴ from the building proper and from individual parts of members which results conveniently to the whole building."

A detailed description of what is a *modulus* is offered by Vitruvius (1.2.4) in the following passage: "Modular sizes⁵ are a convenient coordination of members of the work itself and the corresponding appearance of the whole

¹ A short history of modular coordination since the Vitruvian *commodulatio* find in the paper by Mark Hartland Thomas, 'Modular coordination Hind-sight and Foresight' (*The Modular Quarterly* No 3, London 1967). See also Enzo Frateili, 'I tempi profetici e sagistici della coordinazione modulare' (*Prefabbricare* XI/1, Milano 1968).

² There are many modern translations of Vitruvius. Though linguistically correct, they obscure the Vitruvius' modular and proportional theory with the use of terms which have changed or lost their original meaning, with the misinterpretation of the generic singular, and with the not understanding of the system of the Roman standard sizes.

³ *Comparatio ad symmetriam* is equivalent to our "coordination of sizes". See note 5.

⁴ *Modulorum sumptio* means "determination or selection of modules". Note

the plural! There are many modules to be determined in a building. Compare with the notes 6 and 8.

⁵ *Symmetria* means "modular sizes". cf *Graeci... modulorum mensuras* συμμετρίαν... *appellaverunt* meaning "Modular sizes were called *symmetria* by Greeks". The quotation is from M. Ceti Faventini, *De Diversis Fabricis Architectonicae*, in the text of *Valentine Rose's* Large Edition, published in Hugh Plommer, *Vitruvius and Later Roman Manuals* (Cambridge, 1973). A module in Roman architecture is equivalent to a whole multiple of a standard Roman unit of length (see *illustration 1*). Modern translations offer for *symmetria* terms "symmetry", "symetrie", "Symmetrie", "simmetria", "simetrija", etc. This is linguistically correct, but it obscures the most important passages of *Vitruvius*. *Symmetria* is not what is understood with "symmetry" today.

figure arising from the selection of the unit of measure⁶ for every single part. As in the human body the system of measures appears in the eurhythmy between cubit, foot, palm, finger, and other particles (**illustration 2**), so it is in the perfect buildings (**illustrations 1, 3, 12, 13**). The selection of standard modular units⁷ can be found in temples either from the thickness of a column, or from the triglyph, or from any other rhythmically repeated unit (**illustrations 4, 5, 6, 7**); in the *ballista*, from the bore or *peritretion*, as called by Greeks (**illustration 8**); in the ship, from the space between two tholepins, two cubit apart (**illustration 9**); and in other works, from their component members" (**illustrations 10, 11, 12, 13, 14, 15, 16**).

The most strongly emphasized Vitruvian praecept is in the following paragraph (3.1.1): "Composition of buildings depends upon modular sizes,⁵ the ratios of which must be most diligently observed by architects. It arises from proportion, called *analogia* by Greeks. Proportion is the selection of a unit of sizes⁸ for every member and for the whole of the building and their coordination, from which appears the ratio of modular sizes.⁵ For without modular sizes⁵ and proportion there is no rational composition for any building,⁹ it must follow the ratio of members of a well shaped man" (**illustration 2, 3**).

The Vitruvian modular theory was used in practice.¹⁰ Dimensions of building components were modular, expressible with the whole multiples of one of the units of the standard system of measures (**illustration 10**). The Roman buildings, as compositions of components, were modular too^{11, 12} (and

⁶ *Ex partibus separatis ratae partis responsus* means "coordination of modules selected from single parts". The singular *ratae partis* is a generic genitive, meaning "of every calculated part" or "of all coordinated modules". See notes 4 and 8. The generic singular is misleading, hence the simplistic belief in modern modular coordination that only one module is sufficient. Since a module is mathematically a common denominator of two or more quantities, the absurdity of only one module in a composition is evident. Number one is a universal common denominator only for prime numbers.

⁷ *Symmetriarum ratiocinatio* means "selection of modular units". A modern attempt to calculate a system of composable units resulted in a series of numbers in a ratio equal to the ratio of standard Roman units of length. See note 14.

⁸ *Ratae partis commodulatio* means "coordination of selected modules". The generic singular is misleading. One element only can not be coordinated; the

term *commodulatio* implies more than one module. Compare the notes 4 and 6.

⁹ More about modules and proportion in: Tine Kurent, 'Proportio and Commodulatio after Vitruvius Compared to Proportion and Modules of Diocletian's Palace in Split' (*Ziva antika* XXI/1, Skoplje 1971).

¹⁰ Tine Kurent, 'The Roman Modular Way' (*Official Architecture and Planning* 12, London 1971).

¹¹ Tine Kurent, Franc Možek, Janez Lapajne, Poskus rekonstrukcije emonske inzulje VII (*Varstvo spomenikov* XII, Ljubljana 1967); — Tine Kurent: *The Modular Eurhythmia of Aediculae in Šempeter* (Dissertationes Musei Nationalis Labacensis, Ljubljana 1970); — Tine Kurent, 'The Modular Analogy of the Roman Palaces in Split and Fishbourne' (*Archaeometry* 12/1, Oxford University 1970); — Tine Kurent, 'The Modular Composition of Diocletian's Palace in Split' (*Ziva antika*, Skoplje 1970); — Tine Kurent, 'Avgustov tempelj v Pulju' (*Arheološki vestnik* XXIII, Ljubljana 1972).

illustrations 12, 13). Finally, the Roman new towns were modular^{12, 21} (and illustration 14).

Unfortunately, after the fall of Rome, the Roman standard sizes were replaced by a host of systems of measures, having only a local validity (illustration 1). Therefore, the architects of the Gothic style resorted to geometrical proportioning (*quadratura, triangulatura*). Renaissance means the rebirth of the modular method, but without its coordinating and compositional power (see the text at the illustration 6). The aesthetic role of the Renaissance module¹³ was of a limited application and the introduction of metre one hundred years ago obscured the role of the system of componible anthropometric sizes in the architectonic composition. Therefore modern architects do not "most diligently" observe the ratio of modular sizes as postulated by Vitruvius. Modern efforts are still generally ignored or misunderstood¹⁴ and the only civilisation without standard componible sizes (= preferred sizes = selected modules) is the present one.

The modular principle,¹⁵ the oldest known account of which is Vitruvius, has been adopted by architects since time immemorial all over the world.¹⁶ The neolithic Stonehenge (note 23) and the (illustration 17) and the old Chinese architecture (illustrations 15, 16) are good examples for modular compositions of civilisations far away in space and time.

¹² Tine Kurent. 'The Analogy in Modular Composition of Roman Fortresses at Caerleon and at Mogorjelo' (*Živa antika* XX/2, Skopljje 1971); — Tine Kurent, 'Silchester the Vitruvian Octagonal town' (*Živa antika* XXII, Skopljje 1972); — Tine Kurent, 'La Composition Modulaire de la Ville Romaine de Lambaesis' (*Živa antika* XXIV/1—2, Skopljje 1974).

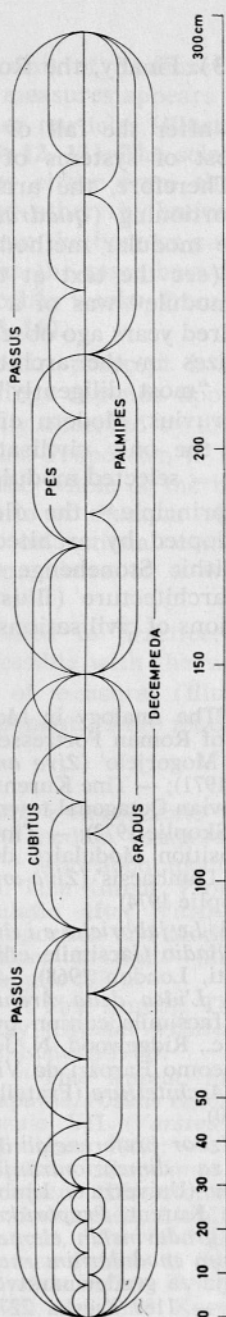
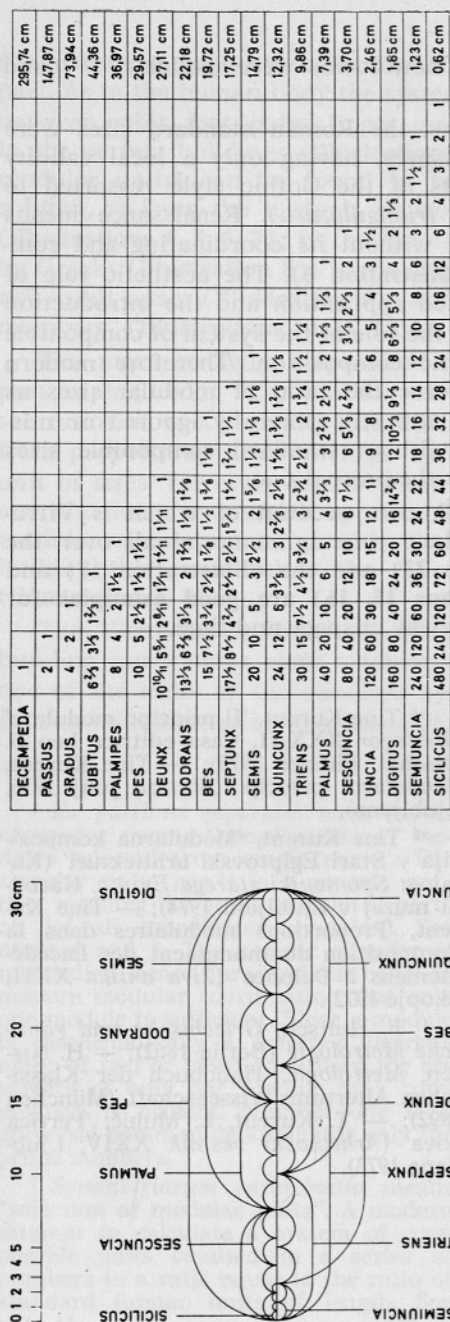
¹³ O. B. Scamozzi, *Le fabbriche e i disegni di Andrea Palladio* (facsimile edition by Alec Tiranti, London 1968); — Vincenzo Scamozzi, *L'idea della Architettura universale* (facsimile edition by The Gregg Press Inc., Ridgewood, N. J., U.S.A., 1964); — Giacomo Barozzi da Vignola, *Gli ordini di Architettura* (Fratelli Vallardi, Milano 1810).

¹⁴ Tine Kurent, *Izbor preferencialnih modularnih mer za dimenzioniranje gradbenih elementov* (Univerza v Ljubljani 1961); — Tine Kurent, *Preporuka za dimenzioniranje građevinskih elementa s komponibilnim modularnim merama* (Dokumentacija za građevinarstvo i arhitekturu, DGA — 1189 sveska 227, Beograd 1972); — Tine Kurent, *Priporočila za dimenzioniranje gradbenih prefabrikatov s komponibilnimi modularnimi merami* (Kompozicija modularnih mer, Univerza v Ljubljani 1974).

¹⁵ Tine Kurent, 'Il principio modulare' (*Belfagor* XXX/II, Casa editrice Leo S. Olshki, Firenze 1975); — Tine Kurent, 'Modularni princip' (*Sinteza* julij 1976, Ljubljana).

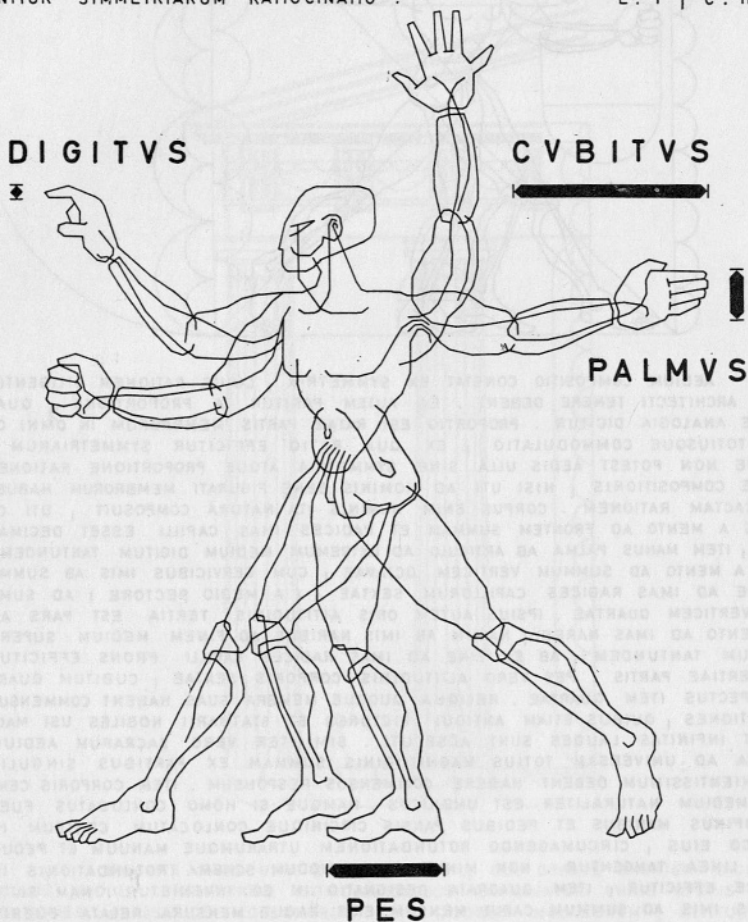
¹⁶ Tine Kurent, 'Modularna kompozicija v Stari Egiptovski arhitekturi' (Katalog: *Spomeniki starega Egipta*, Narodni muzej v Ljubljani 1974); — Tine Kurent, 'Proportions modulaires dans la Composition du monument des Lacédémoniens à Delphes' (*Živa antika* XXII, Skopje 1972).

¹⁷ F. Hultsch, *Griechische und römische Metrologie* (Berlin 1862); — H. Nissen, *Metrologie, Handbuch der Klassischen Altertums-Wissenschaft* (München 1892); — T. Kurent, L. Muhič, 'Pertica nova' (*Arheološki vestnik* XXIV, Ljubljana 1973).



The system of Roman standard sizes.¹⁷ Units of length, called for mnemonic reason after the parts of the human body, are in the ratio of small integers. Hence their comparability.¹⁸ They, or their simple multiples, were used as modules in the Roman architectural composition. Modular sizes of Roman building components,¹⁹ buildings²¹ and new towns,¹² vases,¹⁹ weapons and other tools, can be expressed with Roman standard sizes, called with the Greek name *symmetria* by Vitruvius.

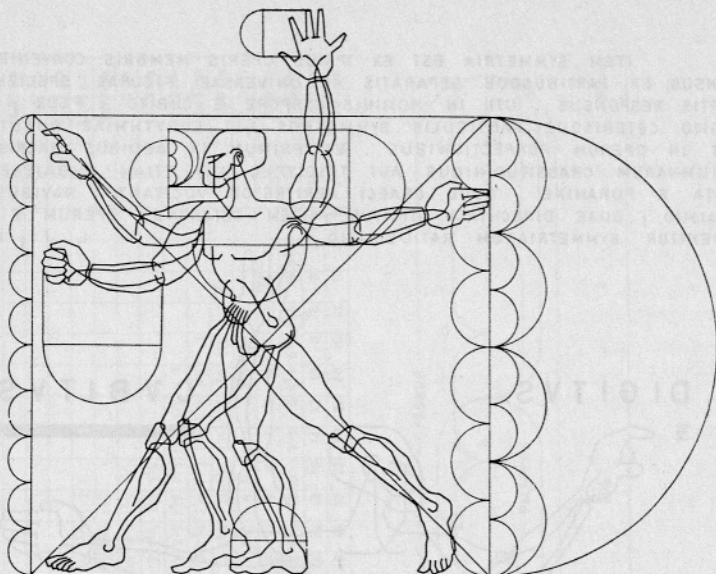
ITEM SYMMETRIA EST EX IPSIUS OPERIS MEMBRIS CONVENIENS CONSENSUS: EX PARTIBUSQUE SEPARATIS AD UNIVERSAE FIGURAE SPECIEM RATEA PARTIS RESPONSUS. UTI IN HOMINIS CORPORE E CUBITO, PEDE, PALMO, DIGITO CETERISQUE PARTICULIS SYMMETROS EST EURYTHMIAE QUALITAS, SIC EST IN OPERUM PERFECTIONIBUS. ET PRIMUM IN AEDIBUS SACRIS AUT E COLUMNARUM CRASSITUDINIBUS AUT TRIGLYPHO AUT ETIAM EMBATERE, BALISTA E FORAMINE, QUOD GRAECI PERITRETON VOCITANT, NAVIBUS INTERSCALMIO, QUAE DIPECHYAIA DICITUR, ITEM CETERORUM OPERUM E MEMBRIS INVENITUR SYMMETRIARUM RATIOCINATIO. L. I, C. II, 4



NAMQUE NON POTEST AEDIS ULLA SINE SYMMETRIA ATQUE PROPORTIONE RATIONEM HABERE COMPOSITIONES, NISI UTI HOMINIS BENE FIGURATI MEMBRORUM HABUERIT EXACTAM RATIONEM. L. III, C. I, 1
 ERGO SI ITA NATURA COMPOSUIT CORPUS HOMINIS, UTI PROPORTIONIBUS MEMBRA AD SUMMAM FIGURATIONEM EIUS RESPONDEANT, CUM CASSA CONSTITUISSE VIDENTUR ANTIQVI, UT ETIAM IN OPERUM PERFECTIONIBUS SINGULORUM MEMBRORUM AD UNIVERSAM FIGURAE SPECIEM HABEANT COMMENSUS EXACTIONEM. L. III, C. I, 4

Illustration 2

As in the human body, from cubit, foot, palm, digit and other small parts comes the eurhythmic quality of modular sizes,⁵ so it is in the completed building (1.2.4.).



AEDIIUM COMPOSITIO CONSTAT EX SYMMETRIA , CUIUS RATIONEM DILIGENTI-
SSIME ARCHITECTI TENERE DEBENT . EA AUTEM PARITUR A PROPORZIONE , QUAE
GRAECE ANALOGIA DICITUR . PROPORTIO EST RATEAE PARTIS MEMBRORUM IN OMNI O-
PERE TOTIUSQUE COMMODATIO , EX QUA RATIO EFFICITUR SYMMETRIARUM .
NAMQUE NON POTEST AEDIS ULLA SINE SYMMETRIA ATQUE PROPORZIONE RATIONEM
HABERE COMPOSITIONIS , NISI UTI AD HOMINIS BENE FIGURATI MEMBRORUM HABUE-
RIT EXACTAM RATIONEM . CORPUS ENIM HOMINIS ITA NATURA COMPOSITUM , UTI OS
CAPITIS A MENTO AD FRONTEM SUMMAM ET RADICES IMAS CAPILLI ESSET DECIMAE
PARTIS , ITEM MANUS PALMA AB ARTICULO AD EXTREMUM MEDIUM DIGITUM TANTUNDEM ,
CAPUT A MENTO AD SUMMUM VERTICEM OCTAVAE , CUM CERVICIBUS IMIS AB SUMMO
PECTORE AD IMAS RADICES CAPILLORUM SEXTAE , (A MEDIO PECTORE) AD SUM-
MUM VERTICEM QUARTAE . IPSIUS AUTEM ORIS ALTITUDINIS TERTIA EST PARS AB
IMO MENTO AD IMAS NARES , NASUM AB IMIS NARIBUS AD FINEM MEDIUM SUPER-
CILIORUM TANTUNDEM , AB EA FINE AD IMAS RADICES CAPILLI FRONS EFFICITUR
ITEM TERTIAE PARTIS . PES VERO ALTITUDINIS CORPORIS SEXTAE , CUBITUM QUAR-
TAE , PECTUS ITEM QUARTAE . RELIQUA QUOQUE MEMBRA SUAS HABENT COMMENSUS
PROPORTIONES , QUIBUS ETIAM ANTIQUI PICTORES ET STATUARIJ NOBILES USI MAG-
NAS ET INFINITAS LAUDES SUNT ACSECUTI . SIMILITER VERO SACRARUM AEDIIUM
MEMBRA AD UNIVERSAM TOTIUS MAGNITUDINIS SUMMAM EX PARTIBUS SINGULIS
CONVENIENTISSIMUM DEBENT HABERE COMMENSUS RESPONSUM . ITEM CORPORIS CEN-
TRUM MEDIUM NATURALITER EST UMBILICUS . NAMQUE SI HOMO CONLOCATUS FUE-
RIT SUPINUS MANIBUS ET PEDIBUS PANSIS CIRCINIQUE CONLOCATUM CENTRUM IN
UMBILICO EIUS , CIRCUMAGENDO ROTUNDATIONEM UTRARUMQUE MANUUM ET PEDUM
DIGITI LINEA TANGENTUR . NON MINUS QUEMADMODUM SCHEMA ROTUNDATIONIS IN
CORPORE EFFICITUR , ITEM QUADRATA DESIGNATIO IN EO INVENIETUR . NAM SI A
PEDIBUS IMIS AD SUMMUM CAPUT MENSUM ERIT EAQUE MENSURA RELATA FUERIT
AD MANUS PANSAS , INVENIETUR EADEM LATITUDO UTI ALTITUDO , QUEMADMODUM
AREAE QUAE AD NORMAM SUNT QUADRATAE . ERGO SI ITA NATURA COMPOSITUM COR-
PUS HOMINIS , UTI PROPORTIONIBUS MEMBRA AD SUMMAM FIGURATIONEM EIUS
RESPONDEANT , CUM CAUSA CONSTITUISSE VIDENTUR ANTIQUI , UT ETIAM IN O-
PERUM PERFECTIONIBUS SINGULORUM MEMBRORUM AD UNIVERSAM FIGURAE SPECIEM
HABEANT COMMENSUS EXACTIONEM . IGITUR CUM IN OMNIBUS OPERIS ORDINES
TRADERENT , MAXIME IN AEDIBUS DEORUM , OPERUM ET LAUDES ET CULPAE AETER-
NAE SOLENT PERMANERE .

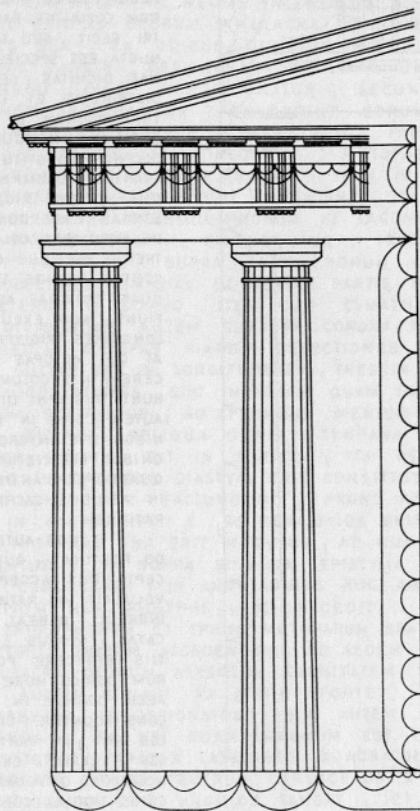
L. III , C. I , 1 , 2 , 3 , 4

Illustration 3

Composition of buildings consists of modular sizes,⁵ the ratio of which the architects should most diligently observe. It arises from proportion which in Greek is called analogia. Proportion is (in the) commodulation of all parts⁶ calculated for the members and the whole of the edifice. For no building can have a rational composition without modular sizes⁵ and proportion, as they are in a finely-shaped human body. For Nature has composed the human body so that ... (3.1.1—2.). Follows a long description of human sizes which have lent their names to units of the system of standard sizes, used as building modules.

ITEM SYMMETRIA EST EX IPSIUS OPERIS MEMBRIS CONVENIENS CONSENSUS EX PARTIBUSQUE SEPARATIS AD UNIVERSAE FIGURAE SPECIEM RATEAE PARTIS RESPONSUS . UTI IN HOMINIS CORPORE E CUBITO | PEDE | PALMO | DIGITO CETERISQUE PARTICULIS SYMMETROS EST EURYTHMIAE QUALITAS | SIC EST IN OPERUM PERFECTIONIBUS . ET PRIMUM IN AEDIBUS SACRIS AUT E COLUMNARUM CRASSITUDINIBUS AUT TRIGLYPHO AUT ETIAM EMBATERE | BALLISTA E FORAMINE | QUOD GRAECI PERITRETON VOCITANT | NAVIBUS INTERSCALMIO | QUAE DIPECHYAIA DICITUR | ITEM CETERORUM OPERUM E MEMBRIS INVENITUR SYMMETRIARUM RATIOCINATIO .

L. I | C. II | 4



EX HIS PARS UNA ERIT MODULUS | QUI GRAECE EMBATER DICITUR | CUIUS MODULI CONSTITUTIONE RATIOCINATIONIBUS EFFICIUNTUR OMNIS OPERIS DISTRIBUTIONES . CRASSITUDO COLUMNARUM ERIT DUORUM MODULORUM | ALTITUDO CUM CAPITULO XIII .

L. IV | C. III | 3 | 4

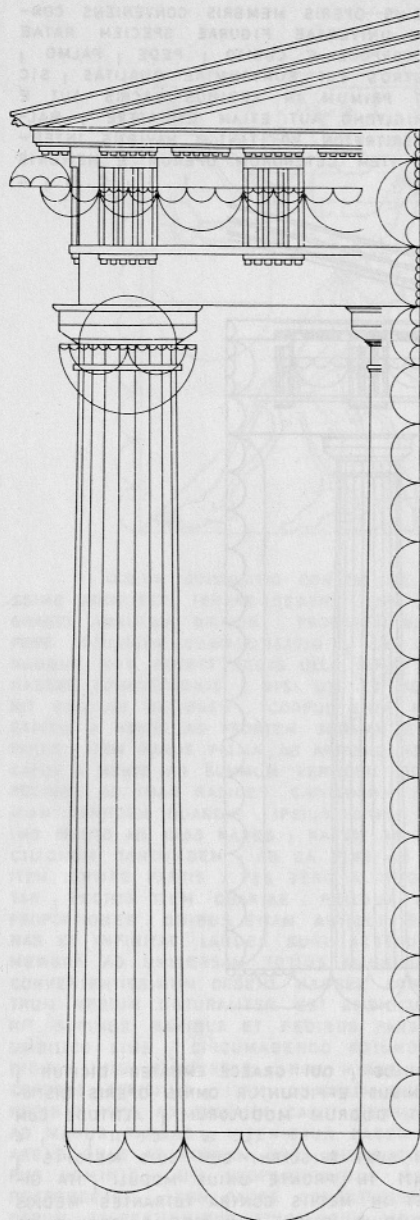
SUPRA EPISTYLIUM CONLOCANDI SUNT TRIGLYPHI CUM SUIS METOPIS | ALTI UNIUS ET DIMIDIATI MODULI | LATI IN FRONTE UNIUS MODULI | ITA DIVISI | UT IN ANGULARIBUS COLUMNIS ET IN MEDIIS CONTRA TETRANTES MEDIOS SINT CONLOCATI | ET INTERCOLUMNIIS RELIQUIS BINI | IN MEDIIS PRONAO ET POSTICO TERNI .

L. IV | C. III | 4

Illustration 4

Modular sizes⁵ ... in temples ... can be calculated ... from the thickness of columns, or a triglyph and also from the embater (1.2.4).

Embater, translated as 'module' by Bury, means a standard size. The verb ἐμβατεῖν, meaning 'to walk', implies the movement of a human body, analogous to the latin *passus* and *gradus*. In extension, *embater* means only other rhythmically repeated unit of sizes.



NONNULLI ANTIQUI ARCHITECTI
NEGAVERUNT DORICO GENERE AESDES
CRAS OPORTERE FIERI, QUOD MENDO-
SAE ET DISCONVENIENTES IN HIS SYMME-
TRIAE CONFICIEBANTUR. ITAQUE NEGAVIT
ARCESIUS, ITEM PYTHIUS, NON MINUS
HERMOGENES. NAM IS CUM PARATAM HA-
BUISSSET MARMORIS COPIAM IN DORICAE
AEDIS PERFECTIONEM, COMMUTAVIT EX EA-
DEM COPIA ET EAM IONICAM LIBERO PA-
TRI FECIT. SED TAMEN NON QUOD INVE-
NUSTA EST SPECIES AUT GENUS AUT FOR-
MAE DIGNITAS, SED QUOD INPEDITA EST
DISTRIBUTIO ET INCOMMODA IN OPERE
TRIGLYPHORUM ET LACUNARIORUM DISTRI-
BUTIONE. NAMQUE NECESSE EST TRY-
GLYPHOS CONSTITUI CONTRA MEDIOS TE-
TRANDES COLUMNARUM, METOPASQUE,
QUAE INTER TRIGLYPHOS FIENT, AEQUE
LONGAS ESSE QUAM ALTAS. CONTRAQUE
IN ANGULARES COLUMNAS TRIGLYPHI IN EX-
TREMIS PARTIBUS CONSTITUUNTUR ET NON
CONTRA MEDIOS TETRANTES. ITA METOPA
QUAE PROXIMAE AD ANGULARES TRIGLYPHOS
FIUNT, NON EXEUNT QUADRATAE SED OB-
LONGIORES TRIGLYPHI DIMIDIA LATITUDINE.
AT QUI METOPAS AEQUALES VOLUNT FA-
CERE, INTERCOLUMNIA EXTREMA CONTRA-
HUNT TRIGLYPHI DIMIDIA LATITUDINE. HOC
AUTEM, SIVE IN METOPARUM LONGITUDI-
NIBUS SIVE INTERCOLUMNIORUM CONTRACTI-
ONIBUS EFFICIETUR, EST MENDOSUM.
QUAPROPTER ANTIQUI VITARE VISI SUNT
IN AEDIBUS SACRIS DORICAE SYMMETRIAE
RATIONEM

NOS AUTEM EXPONIMUS, UTI OR-
DO POSTULAT, QUEMADMODUM A PRAE-
CEPTORIBUS ACCEPIMUS, UTI, SI QUI
VOLUERIT HIS RATIONIBUS ADTENDENS ITA
INGREDI, HABEAT PROPORTIONES EXPLI-
CATAS, QUIBUS EMENDATAS ET SINE VI-
TIIS EFFICERE POSSIT AEDIIUM SACRA-
RUM DORICO MORE PERFECTIONES. FRONS
AEDIS DORICAE IN LOCO, QUO COLUMNAE
CONSTITUUNTUR, DIVIDATUR, SI TETRASTY-
LOS ERIT, IN PARTES XXVII, SI HEXASTY-
LOS, XXXII. EX HIS PARS UNA ERIT
MODULUS, QUI GRAECOE EMBATER DICITUR,
CUIUS MODULI CONSTITUTIONE RATIOCINATI-
ONIBUS EFFICIUNTUR OMNIS OPERIS DIS-
TRIBUTIONES. CRASSITUDO COLUMNARUM
ERIT DUORUM MODULORUM, ALTITUDO CUM
CAPITULO XIII. CAPITULI CRASSITUDO U-
NIUS MODULI, LATITUDO DUORUM ET MO-
DULI SEXTAE PARTIS. CRASSITUDO CAPI-
TULI DIVIDATUR IN PARTES TRES, E QUI-
BUS UNA PLINTHUS CUM CYMATIO FIAT,
ALTERA ECHINUS CUM ANULIS, TERTIA HY-
POTRACHELION. CONTRAHATUR COLUMNA ITA,

Illustration 5 a and b

Vitruvius' prescription for the modular composition of the Doric order.

UTI IN TERTIO LIBRO DE IONICIS EST SCRIPTUM . EPISTYLII ALTI TUDO UNUS MODULI CUM TAENIA ET GUTTIS ; TAENIA MODULI SEPTIMA ; GUTTURUM LONGITUDO SUB TAENIA CONTRA TRIGLYPHOS ALTA CUM REGULA PARTE SEXTA MODULI PRAEPEDEAT . ITEM EPISTYLII LATITUDO IMA RESPONDEAT HYPOTRACHELIO SUMMAE COLUMNNAE . SUPRA EPISTYLIIUM CONLOCANDI SUNT TRIGLYPHI CUM SUI METOPIS , ALTI UNUS (ET) DIMIDIATI MODULI , LATI IN FRONTE UNUS MODULI , ITA DIVISI , UT IN ANGULARIBUS COLUMNNIS ET IN MEDIIS CONTRA TETRANTES MEDIOS SINT CONLOCATI , ET INTERCOLUMNNIIS RELIQUIS BINI , IN MEDIIS PRONA ET POSTICO TERNI . ITA RELAXATIS MEDIIS INTERVALLIIS SINE INPEDITIONIBUS ADITUS ACCEDENTIBUS ERIT AD DEORUM SIMULACRA . TRIGLYPHORUM LATITUDO DIVIDATUR IN PARTES SEX , EX QUIBUS QUINQUE PARTIBUS IN MEDIO , DUAE DIMIDIAE DEXTRA AC SINISTRA DESIGNENTUR REGULA . UNA IN MEDIO DEFORMETUR FEMUR , QUOD GRAECE MEROS DICITUR ; SECUNDUM EAM CANALICULI AD NORMAE CACUMEN INPRIMANTUR ; EX ORDINE EORUM DEXTRA AC SINISTRA ALTERA FEMINA CONSTITUANTUR ; IN EXTREMIS PARTIBUS SEMICANALICULI INTERVERTANTUR . TRIGLYPHIS ITA CONLOCATIS , METOPAE QUAE SUNT INTER TRIGLYPHOS , AEQUE ALTAE SINT QUAM LONGAE ; ITEM IN EXTREMIS ANGULIS SEMIMETOPIA SINT IMPRESSA DIMIDIA MODULI LATITUDINE . ITA ENIM ERIT , UT OMNIA VITIA ET METOPARUM ET INTERCOLUMNNIORUM ET LACUNARIORUM , QUOD AEQUALES DIVISIONES FACTAE ERUNT , EMENDENTUR . TRIGLYPHI CAPITULA SEXTA PARTE MODULI SUNT FACIENDA . SUPRA TRIGLYPHORUM CAPITULA CORONA EST CONLOCANDA IN PROIECTURA DIMIDIAE ET SEXTAE PARTIS HABENS CYMATIUM DORICUM IN IMO , ALTERUM IN SUMMO . ITEM CUM CYMATIIS CORONA CRASSA EX DIMIDIA MODULI , DIVIDENDAE AUTEM SUNT IN CORONA IMA AD PERPENDICULUM TRIGLYPHORUM ET MEDIAS METOPAS VIARUM DERECTIONES ET GUTTURUM DISTRIBUTIONES , ITA UTI GUTTAE SEX IN LONGITUDINEM , TRES IN LATITUDINEM PATEANT . RELIQUA SPATIA , QUOD LATIORES SINT METOPAE QUAM TRIGLYPHI , PURA RELIQUANTUR AUT NUMINA SCALPANTUR , AD IPSUMQUE MENTUM CORONAE INCIDATUR LINEA QUAE SCOTIA DICITUR . RELIQUA OMNIA , TYMPANA , SIMAE , CORONAE , QUEMADMODUM SUPRA SCRIPTUM EST IN IONICIS , ITA PERFICIANTUR .

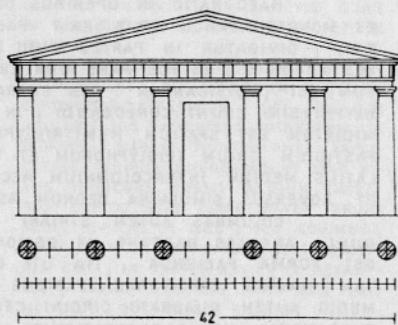
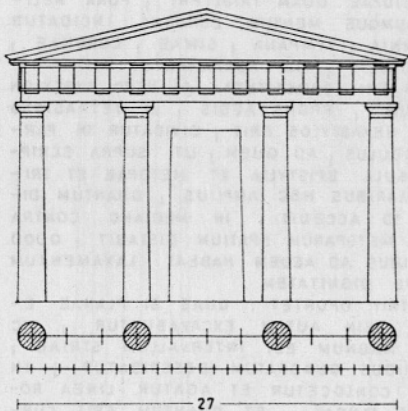
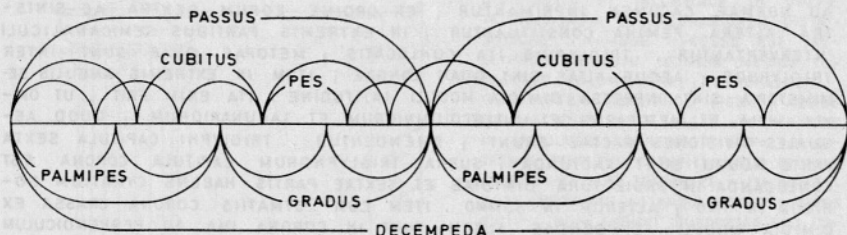
HAEC RATIO IN OPERIBUS DIASTYLI ERIT CONSTITUTA . SI VERO SYSTYLOS ET MONOTRIGLYPHON OPUS ERIT FACIUNDUM , FRONS AEDIS , SI TETRASTYLO ERIT , DIVIDATUR IN PARTES XVIII S , SI HEXASTYLOS ERIT , DIVIDATUR IN PARTES XXVIII S . EX HIS PARS UNA ERIT MODULUS , AD QUEM , UTI SUPRA SCRIPTUM EST , DIVIDANTUR . ITA SUPRA SINGULA EPISTYLIA ET METOPAE ET TRIGLYPHI BINI ERUNT CONLOCANDI ; IN ANGULARIBUS HOC AMPLIUS , QUANTUM DIMIDIATUM EST SPATIUM HEMITRIGLYPHI , ID ACCEDIT . IN MEDIANO CONTRA FASTIGIUM TRIUM TRIGLYPHORUM ET TRIUM METOPARUM SPATIUM DISTABIT , QUOD LATIUS MEDIUM INTERCOLUMNNIUM ACCEDENTIBUS AD AEDEM HABEAT LAXAMENTUM ET ADVERSUS SIMULACRA DEORUM ASPECTUS DIGNITATEM .

COLUMNAS AUTEM STRIARI XX STRII OPORTET . QUAE SI PLANAE ERUNT , ANGULOS HABEANT XX DESIGNATOS . SIN AUTEM EXCAVABUNTUR , SIC EST FORMA FACIENDA , ITA UTI QUAM MAGNUM EST INTERVALLUM STRIAE , TAM MAGNIS STRIATURAE PARIBUS LATERIBUS QUADRATUM DESCRIBATUR ; IN MEDIO AUTEM QUADRATO CIRCINI CENTRUM CONLOCETUR ET AGATUR LINEA ROTUNDATIONIS , QUAE QUADRATIONIS ANGULOS TANGAT , ET QUANTUM ERIT CURVATURAE INTER ROTUNDATIONEM ET QUADRATAM DESCRIPTIONEM , TANTUM AD FORMAM EXCAVENTUR . ITA DORICA COLUMNA SUI GENERIS STRIATURAE HABEBIT PERFECTIONEM . DE ADIECTIONE EIUS , QUAE MEDIA ADAUGETUR , UTI IN TERTIO VOLUMINE DE IONICIS EST PERSCRIPTA , ITA ET IN HIS TRANSFERATUR .

QUONIAM EXTERIOR SPECIES SYMMETRIARUM ET CORINTHIORUM ET DORICORUM ET IONICORUM EST PERSCRIPTA , NECESSE EST ETIAM INTERIORES CELLARUM PRONAQUE DISTRIBUTIONES EXPLICARE .

L. IV , C. III

ITEM SYMMETRIA EST EX IPSIUS OPERIS MEMBRIS CONVENIENS CON-
SENSUS EX PARTIBUSQUE SEPARATIS AD UNIVERSAE FIGURAE SPECIEM RATAE
PARTIS RESPONSUS . UTI IN HOMINIS CORPORE E CUBITO , PEDE , PALMO ,
DIGITO CETERISQUE PARTICULIS SYMMETROS EST EURYTHMIAE QUALITAS , SIC
EST IN OPERUM PERFECTIONIBUS . ET PRIMUM IN AEDIBUS SACRIS AUT E
COLUMNARUM CRASSITUDINIBUS AUT TRIGLYPHO AUT ETIAM EMBATERE , BAL-
LISTA E EORAMINE , QUOD GRAECI PERITRETON VOCITANT , NAVIBUS INTER-
SCALMIO , QUAE DIPECHYAIA DICITUR , ITEM CETERORUM OPERUM E MEMBRIS
INVENITUR SYMMETRIARUM RATIOCINATIO . L. I , C. II , 4



FRONS AEDIS DORICAE IN LOCO , QUO COLUMNAE CONSTITUUNTUR ,
DIVIDATUR SI TETRASTYLOS ERIT , IN PARTES XXVII , SI HEXASTYLOS , XXXXII
EX HIS PARS UNA ERIT MODULUS , QUI GRAECE EMBATER DICITUR , CUIUS
MODULI CONSTITUTIONE RATIOCINATIONIBUS EFFICIUNTUR OMNIS OPERIS DISTRI-
BUTIONES CRASSITUDO COLUMNARUM ERIT DUORUM MODULORUM , ALTITUDO CUM
CAPITULO XIII . L. IV , C. III , 3

Illustration 6

The modular composition of a Doric temple.

The front of a Doric temple is to be divided along the line where columns are set, in 27 parts if it is tetrastyle, in 42 parts if it is hexastyle.²⁰ Of these one part will be the module, which in Greek is called embater, and when it is constituted its multiples affect the distribution of the whole work. The diameter of the column will be two modules; the height including capital 14, the height of the capital is one module... Above the architrave are to be placed the triglyphs with the methopes; the triglyphs being a module and a half high and one module wide in front... (4. 3. 3—4.).

This and other prescriptions for modular composition of temples suggest that Vitruvius had in mind Greek examples, but without knowing the Greek standard sizes, used as modules. Therefore he equated the module with the column's diameter, and the dimensions of triglyphs and methopes, which were obviously expressible with Greek units of length. The same misjudgement occurred in the Renaissance, when the modular principle was reintroduced, but without regard to a standard system of sizes. The universal Roman sizes were supplanted by a host of measures. In Italy there were *piede Vicentino*, *piede Veneto*, *canna di Roma*, Palermo, Genova, Toscana, Sicilia, Sardegna, etc, which introduced the confusion of the tower of Babel in the architectural composition of sizes. Therefore the Renaissance architecture arbitrarily, and under the influence of Vitruvius, proclaimed as module the diameter (or radius) of a column. Since one only module was not enough, the diameter was divided in 12, 18, or more, partes.¹³ Consequently the module lost its power to coordinate sizes and degenerated into an aesthetic tool.

¹⁸ Tine Kurent, 'Modularna kompozicija' (*Arhitektura — urbanizam* br. 26, Beograd 1964); — Tine Kurent, 'The Basic Law of Modular Composition' (*The Modular Quarterly*, winter 1964/65, London); — Tine Kurent, *Osnovni zakon modularne kompozicije* (Univerza v Ljubljani, Fakulteta za arhitekturo 1967); — Tine Kurent, *La legge fondamentale della composizione modulare* (Politecnico di Torino, Facoltà di Architettura, Edizione Quaderni di Studio, Torino 1968); — Tine Kurent, *Kompozicija modularnih mer* (Univerza v Ljubljani, Fakulteta za arhitekturo 1974).

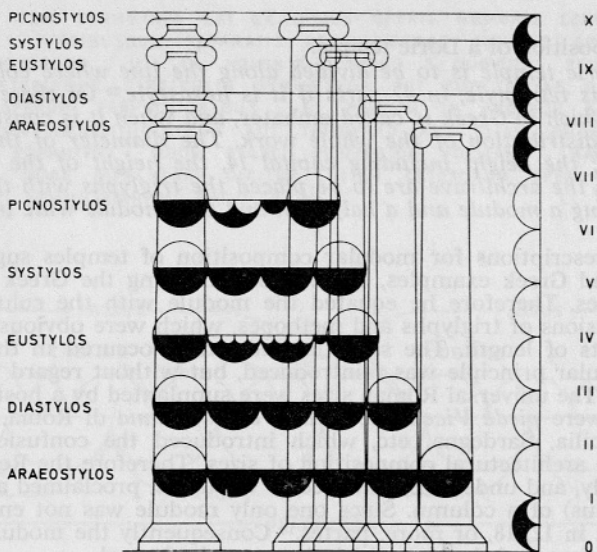
¹⁹ T. Kurent, L. Muhič, 'Merska analiza rimskih posod' (*Arheološki vestnik* XXIII, Ljubljana 1972).

²⁰ An attempt to explain the antique proportions with the Vitruvian numbers without resorting to the Greek and Roman standard sizes is in C. J. Moe, *Numeri di Vitruvio* (Edizioni del Milione, Milano 1945).

²¹ Milica Detoni, Tine Kurent, *The Modular Reconstruction of Emona* (Dissertationes Musei Nationalis Labacensis, Ljubljana 1963).

²² Tine Kurent, 'La composizione modulare della Porta Palatina a Torino' (*Prefabbricare* 5, Milano 1969).

²³ Tine Kurent, 'Stonehenge and the Vitruvian Amusium' (*Architectural Association Quarterly*, vol. 7 number 3, London 1975).



SPECIES AUTEM AEDIIUM SUNT QUINQUE, QUARUM EA SUNT VOCABULA: PYCNOSTYLOS, ID EST CREBRIS COLUMNIS; SYSTYLOS PAULO REMISSIORIBUS; DIASTYLOS AMPLIUS PATENTIBUS; RARE QUAM OPORTET INTER SE DUCTUS ARAEOSTYLOS; EUSTYLOS INTERVALLORUM IUSTA DISTRIBUTIONE. ERGO PYCNOSTYLOS EST, CUIUS INTERCOLUMNIO UNIUS ET DIMIDIATAE COLUMNAE CRASSITUDO INTERPONI POTEST, QUEMADMODUM EST DIVI IULII ET IN CAESARIS FORO VENERIS ET SI QUAE ALIAE SIC SUNT COMPOSITAE. ITEM SYSTYLOS EST, IN QUO DUARUM COLUMNARUM CRASSITUDO IN INTERCOLUMNIO POTERIT CONLOCARI, ET SPICRARUM PLINTHIDES AEQUE MAGNAE SINT ET SPATIO, QUOD FUERIT INTER DUS PLINTHIDES, QUEMADMODUM EST FORTUNAE EQUESTRI AD THEATRUM LAPIDEUM RELIQUAEQUE, QUAЕ EISDEM RATIONIBUS SUNT COMPOSITAE. HAEC UTRAQUE GENERA VITIOSUM HABENT USUM. MATRES ENIM FAMILIARUM CUM AD SUPPLICATIONEM GRADIBUS ASCENDUNT, NON POSSUNT PER INTERCOLUMNIA AMPLEXAE ADIRE, NISI ORDINES FECERINT; ITEM VALVARUM ADPECTUS ABSTRADITUR COLUMNARUM CREBRITATE IPSAQVE SIGNA OBSCURANTUR; ITEM CIRCA AEDEM PROPTER ANGIUSTIAS INPEDIUNTUR AMBULATIONES. DIASTYLI AUTEM HAEC ERIT COMPOSITIO, CUM TRIUM COLUMNARUM CRASSITUDINEM INTERCOLUMNIO INTERPONERE POSSUMUS, TAMQAM EST APOLLONIS ET DIANAE AEDIS. HAEC DISPOSITIO HANC HABET DIFFICULTATEM, QUOD EPISTYLIA PROPTER INTERVALLORUM MAGNITUDINEM FRANGUNTUR. IN ARAEOSTYLIS AUTEM NEC LAPIDEIS NEC MARMOREIS EPISTYLIIS UTI DATUR, SED INPONENDAE DE MATERIA TRABES PERPETUAE. ET IPSARUM AEDIIUM SPECIES SUNT VARICAE, BARYCEPHALAE, HUMILES, LATAE, ORNANTURQUE SIGNIS FICTILIBUS AUT AEREIS INAURATIS EARUM FASTIGIA TUSCANICO MORE, UTI EST AD CIRCUM MAXIMUM CERERIS ET HERCULIS POMPEIANI, ITEM CAPITOLI.

REDDENDA NUNC EST EUSTYLI RATIO, QUAЕ MAXIME PROBABILIS ET AD USUM ET AD SPECIEM ET AD FIRMITATEM RATIONES HABET EXPLICATAS. NAM QUAЕ FACIENDA SUNT IN INTERVALLIS SPATIA DUARUM COLUMNARUM ET QUARTAE PARTIS COLUMNAE CRASSITUDINIS, MEDIUMQUE INTERCOLUMNIUM UNUM, QUOD ERIT IN FRONTE, ALTERUM, QUOD IN POSTICO, TRIUM COLUMNARUM CRASSITUDINE. SIC ENIM HABEBIT ET FIGURATIONIS ASPECTUM VENUSTUM ET ADITUS USUM SINE INPEDIATIONIBUS ET CIRCA CELLAM AMBULATIO AUCTORITATEM. HUIUS AUTEM REI RATIO EXPLICABITUR SIC. FRONS LOCI QUAЕ IN AEDE CONSTITUTA FUERIT, SI TE-

Illustration 7 a and b

Vitruvius' instruction on how to compose the elevation of temples. The various arrangements of columns, i.e. the width and height of the axial *intercolumnium* with regard to the thickness of the column (= module) result in *pycnostylos*, *systylos*, *eustylos*, *diastylos*, and *araeostylos*.

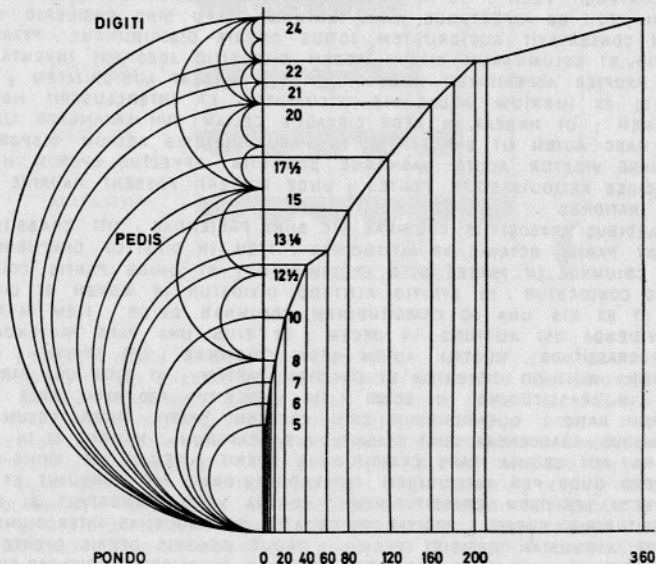
TRASTYLOS FACIENDA FUERIT , DIVIDATUR IN PARTES XI S PRAETER CREPIDINES ET PROIECTURAS SPIRARUM ; SI SEX ERIT COLUMNARUM , IN PARTES XVIII ; SI OCTOSTYLOS CONSTITUETUR , DIVIDATUR IN XXIV ET SEMISSEM . ITEM EX HIS PARTIBUS SIVE TETRASTYLI SIVE HEXASTYLI SIVE OCTOSTYLI UNA PARS SUMATUR , EAQUE ERIT MODULUS . CUIUS MODULI UNIUS ERIT CRASSITUDINIS COLUMNARUM . INTERCOLUMNIA SINGULA , PRAETER MEDIA , MODULORUM DUORUM ET MODULI QUARTAE PARTIS ; MEDIANA IN FRONTE ET POSTICO SINGULA TERNUM MODULORUM . IPSARUM COLUMNARUM ALTITUDO MODULORUM HABEBUNT IUSTAM RATIONEM . HUIUS EXEMPLAR ROMAE NULLUM HABEMUS , SED IN ASIA TEO HEXASTYLON LIBERI PATRIS .

EAS AUTEM SYMMETRIAS CONSTITUIT HERMOGENES , QUI ETIAM PRIMUS EXO STYLON PSEUDODIPTERIVE RATIONEM . EX DIPTERI ENIM AEDIS SYMMETRIAE DISTULIT INTERIORES ORDINES COLUMNARUM XXXIV EAQUE RATIONE SUMPTUS OPERASQUE COMPENDII FECIT . IS IN MEDIO AMBULATIONI LAXAMENTUM EGREGIE CIRCA CELLAM FECIT DE ASPECTUQUE NIHIL INMINUIT , SED SINE DESIDERIO SUPERVACUORUM CONSERVAVIT AUCTORITATEM TOTIUS OPERIS DISTRIBUTIONE . PTEROMATOS ENIM RATIO ET COLUMNARUM CIRCUM AEDEM DISPOSITIO IDEO EST INVENTA , UT ASPECTUS PROPTER ASPERITATEM INTERCOLUMNIORUM HABEAT AUCTORITATEM , PRAETEREA , SI EX IMBRIUM AQUAE VIS OCCUPAVERIT ET INTERCLUSERIT HOMINUM MULTITUDINEM , UT HABEAT IN AEDE CIRCAQUE CELLAM CUM LAXAMENTO LIBERAM MORAM . HAEC AUTEM UT EXPLICANTUR IN PSEUDODIPTERIS AEDIIUM DISPOSITIONIBUS . QUARE VIDETUR ACUTA MAGNAQUE SOLLERTIA EFFECTUS OPERUM HERMOGENIS FECISSE RELIQUISSEQUE FONTES , UNDE POSTERI POSSENT HAURIRE DISCIPLINARUM RATIONES .

AEDIBUS ARAEOSTYLIIS COLUMNAE SIC SUNT FACIENDAE , UTI CRASSITUDINES EARUM SINT PARTIS OCTAVAE AD ALTITUDES . ITEM IN DIASTYLO DIMETIENDA EST ALTITUDO COLUMNAE IN PARTES OCTO ET DIMIDIUM , ET UNIUS PARTIS COLUMNAE CRASSITUDO CONLOCETUR . IN SYSTYLO ALTITUDO DIVIDATUR IN NOVE ET DIMIDIAM PARTEM , ET EX EIS UNA AD CRASSITUDINEM COLUMNAE DETUR . ITEM IN PYCNOSTYLO DIVIDENDA EST ALTITUDO IN DECEM , ET EIUS UNA PARS FACIENDA EST COLUMNAE CRASSITUDO . EUSTYLI AUTEM AEDIS COLUMNAE , UTI SYSTYLI , IN NOVE PARTIBUS ALTITUDO DIVIDATUR ET DIMIDIAM PARTEM , ET EIUS UNA PARS CONSTITUATUR IN CRASSITUDINE IMI SCAPI . ITA HABEBITUR PRO RATA PARTE INTERCOLUMNIORUM RATIO . QUEMADMODUM ENIM CRESCUNT SPATIA INTER COLUMNAS , PROPORTIONIBUS ADAUGENDAE SUNT CRASSITUDINIS SCAPORUM . NAMQUE SI IN ARAEOSTYLO NONA AUT DECIMA PARS CRASSITUDINIS FUERIT , TENUIS ET EXILIUS APPAREBIT , IDEO QUOD PER LATITUDINEM INTERCOLUMNIORUM AER CONSUMIT ET INMINUIT ASPECTU SCAPORUM CRASSITUDINEM . CONTRA VERO PYCNOSTYLI SI OCTAVA PARS CRASSITUDINIS FUERIT , PROPTER CREBRITATEM ET ANGUSTIAS INTERCOLUMNIORUM TUMIDAM ET INVENUSTAM EFFICIET SPECIEM . ITAQVE GENERIS OPERIS OPORTET PERSEQUI SYMMETRIAS . ETIAMQUE ANGULARES COLUMNAE CRASSIORES FACIENDAE SUNT EX SUO DIAMETRO QUINQUAGESIMA PARTE , QUOD EAE AB AERE CIRCUMCIDUNTUR ET GRACILIORES VIDENTUR ESSE ASPICIENTIBUS . ERGO QUOD OCULUS FALLIT , RATIOCINATIONE EST EXEQUENDUM . CONTRACTURAE AUTEM IN SUMMIS COLUMNARUM HYPOTRACHELIIS ITA FACIENDAE VIDENTUR , UTI , SI COLUMNA SIT AB MINIMO AD PEDES QUINOS DENOS , IMA CRASSITUDO DIVIDATUR IN PARTES SEX ET EARUM PARTIUM QUINQUE SUMMA CONSTITUATUR . ITEM QUAE ERIT AB QUINDECIM PEDIBUS AD PEDES VIGINTI , SCAPUS IMUS IN PARTES SEX ET SEMISSEM DIVIDATUR , EARUMQUE PARTIUM QUINQUE ET SEMISSE SUPERIOR CRASSITUDO COLUMNAE FIAT . ITEM QUAE ERUNT A PEDIBUS VIGINTI AD PEDES TRIGINTA , SCAPUS IMUS DIVIDATUR IN PARTES SEPTEM , EARUMQUE SEX SUMMA CONTRACTURA PERFICIATUR . QUAE AUTEM AB TRIGINTA PEDIBUS AD QUADRAGINTA ALTA ERIT , IMA DIVIDATUR IN PARTES SEPTEM ET DIMIDIAM ; EX HIS SEX ET DIMIDIAM IN SUMMO HABEAT CONTRACTURAE RATIONEM . QUAE ERUNT AB QUADRAGINTA PEDIBUS AD QUINQUAGINTA , ITEM DIVIDENDAE SUNT IN OCTO PARTES , ET EARUM SEPTEM IN SUMMO SCAPO SUB CAPITULO CONTRAHANTUR . ITEM SI QUAE ALTIORES ERUNT , EADEM RATIONE PRO RATA CONSTITUANTUR CONTRACTURAE . HAEC AUTEM PROPTER ALTITUDINIS INTERVALLUM SCANDENTIS OCULI SPECIES ADICIUNTUR CRASSITUDINIBUS TEMPERATURAE . VENUSTATES ENIM PERSEQUITUR VISUS , CUIUS SI NON BLANDIMUR VOLUPTATI PROPORTIONE ET MODULORUM ADIECTIONIBUS , UTI QUOD FALLITUR TEMPERATIONE ADAUGEATUR , VASTUS ET INVENUSTUS CONSPICIENTIBUS REMITTETUR ASPECTUS . DE ADIECTIONE , QUAE ADICITUR IN MEDIIS COLUMNIS , QUAE APUD GRAECOS ENTASIS APPELLATUR , IN EXTREMO LIBRO ERIT FORMATA RATIO EIUS , QUEMADMODUM MOLLIS ET CONVENIENS EFFICIATUR , SUBSCRIPTA .

ITEM SYMMETRIA EST EX IPSIUS OPERIS MEMBRIS CONVENIENS CONSENSUS EX PARTIBUSQUE SEPARATIS AD UNIVERSAE FIGURAE SPECIEM RATAE PARTIS RESPONSUS . UTI IN HOMINIS CORPORE E CUBITO | PEDE | PALMO | DIGITO CETERISQUE PARTICULIS SYMMETROS EST EURYTHMIAE QUALITAS | SIC EST IN OPERUM PERFECTIONIBUS . ET PRIMUM IN AEDIBUS SACRIS AUT E COLUMNARUM CRASSITUDINIBUS AUT TRIGLYPHO AUT ETIAM EMBATERE | BALLISTA E FORAMINE | QUOD GRAECI PERITRETON VOCITANT | NAVIBUS INTERSCALMIO | QUAE DIPECHYAIA DICITUR | ITEM CETERORUM OPERUM E MEMBRIS INVENITUR SYMMETRIARUM RATIOCINATIO .

L. I | C. II | 4



SED TAMEN NULLA BALLISTA PERFICITUR NISI AD PROPOSITAM MAGNITUDINEM PONDERIS SAXI | QUOD ID ORGANUM MITTERE DEBET .

L. X | C. XI | 1

NAM AUQE BALLISTA DUO PONDO SAXUM MITTERE DEBET | FORAMEN ERIT IN EIUS CAPITULO DIGITORUM V | SI PONDO IIII | DIGITORUM SEX | VI | DIGITORUM VII | DECEM PONDO DIGITORUM VIII | VIGINTI PONDO DIGITORUM X | XL PONDO DIGITORUM XII SK | LX PONDO DIGITORUM XIII ET DIGITI OCTAVA PARTE | LXXX PONDO DIGITORUM XV | CXX PONDO I PEDIS ET SESQUIDIGITI | C ET LX PEDIS 19 | C ET LXXX PES ET DIGITI V | CC PONDO PEDIS ET DIGITORUM VI | CC ET X PEDIS ET DIGITORUM VI | CCCLX | PEDIS I S .

L. X | C. XI | 5

CUM ERGO FORAMINIS MAGNITUDO FUERIT INSTITUTA | DESCRIBATUR SCUTULA | QUAE GRAECI PERITRETOS APPELLATUR | CUIUS LONGITUDO FORAMINUM VIII | LATITUDO DUO ET SEXTAE PARTIS .

L. X | C. XI | 4

Illustration 8

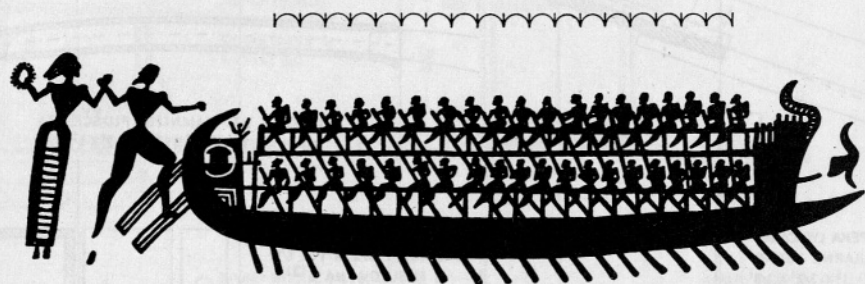
On the modular composition of *ballista*.

But no ballista is made without regard on the proposed amount of the weight of the stone which such a machine is supposed to eject (10.11.1.). When, therefore, the size of the hole (= the caliber) is determined (as a module), the scutula, which in Greek is called peritretos, is to be drawn (10.11.4.).

Follows the recipe what dimensions are to be taken to build a *ballista* and the detailed description of calibers, i.e. the interdependence of apertures of a *foramen* and of the weight of the projectile.

Obviously, the heavier the projectile, the larger the hole, the larger the module, and the larger the *ballista* itself. The module is proportionate to the composition.¹⁸

ITEM SYMMETRIA EST EX IPSIUS OPERIS MEMBRIS CONVENIENS CON-
SENSUS EX PARTIBUSQUE SEPARATIS AD UNIVERSAE FIGURAE SPECIEM RATAE
PARTIS RESPONSUS . UTI IN HOMINIS CORPORE E CUBITO | PEDE | PALMO |
DIGITO CETERISQUE PARTICULIS SYMMETROS EST EURYTHMIAE QUALITAS | SIC
EST IN OPERUM PERFECTIONIBUS . ET PRIMUM IN AEDIBUS SACRIS AUT E
COLUMNARUM CRASSITUDINIBUS AUT TRIGLYPHO AUT ETIAM EMBATERE | BAL-
LISTA E FORAMINE | QUOD GRAECI PERITRETON VOCITANT | NAVIBUS INTER-
SCALMIO | QUAE DIPECHYAIA DICITUR | ITEM CETERORUM OPERUM E MEMBRIS
INVENITUR SYMMETRIARUM RATIOCINATIO L. I | C. II | 4



A GREEK SHIP FROM THE PERIOD OF THE IMIGRATIONS . THE
ROWERS SIT ALONG BOTH SIDES . THIS SCENE | FROM A GEOMETRICAL VASE |
SHOWS A MAN APPARENTLY LEADING A WOMAN ON BOARD | AND IT IS AN
ATTRACTIVE GUESS THAT IT REPRESENTS THE ABDUCTION OF HELEN BY PARIS .
THE BIRTH OF WESTERN CIVILIZATION - GREECE AND ROME | MICHAEL GRANT

... BY THE SPACE BETWEEN THE ROWLOCKS IN A SHIP WHICH IS
CALLED DIPECHYAIA : ... GRANGER | L. I | C. II | 4 | LONDON MCMLXII
... IN A SHIP | FROM THE SPACE BETWEEN THE THOLEPINS (ὀλ-
πηγμα ... MORGAN | L. I | C. II | 4 | NEW YORK 1960
... NAVIBUS | INTERSCALMIO | QUOD διάπηγμα DICITUR | ...
POUR LES NAVIRES : D' APRÈS L' INTERVALLE DES TOLETS | QUI S' AP-
PELLE διάπηγμα ... CHOISY | L. I | C. III | 3 | PARIS 1909
SIMIGLIANTEMENTE NELLE NAVI DALLO SPACIO | CHE E TRA UN
SCHELMO ALL' ALTRO | CHE PER ESSER DI MISURA DI DUE CUBITI | SI
CHIAMA | DIPICHAICHI | ... BARBARO | VENEZIA 1584 | L. I | C. II

Illustration 9

The size of module for a ship is determined from the space between the rowlocks, which is called *dipechyaia* by Greeks.

Embater and *dipechyaia* are the only modules of Vitruvius defined with a specific unit of sizes (See III. 4). The interval of 2 cubits for rowlocks is about 3' or 90 cm. The same rhythm is still used as a module for the arrangement of seats in theaters, etc.

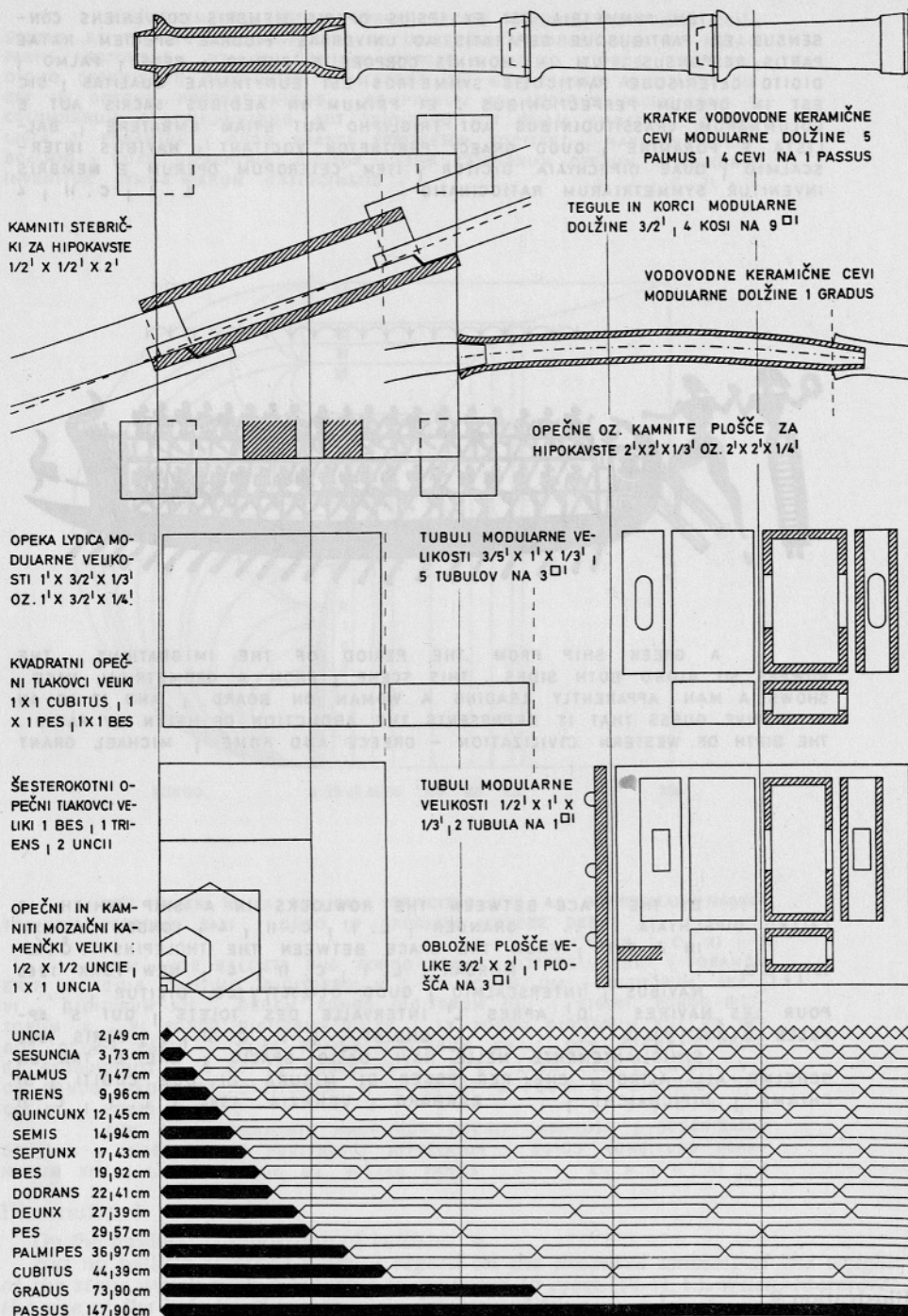


Illustration 10

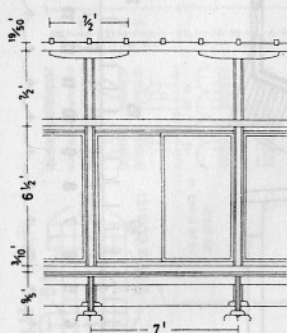
The analysis of Roman building components²¹ disclosed that their sizes were modular and equal to small multiples of a Roman standard unit of sizes.

Since components were modular, the buildings, as their additive and/or multiplicative compositions, were modular too. (See illustration 13.)

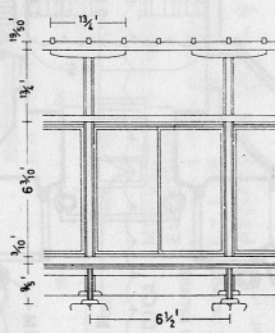
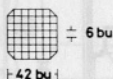
KI-VA-RI-HO MODULARNO PRAVILO JAPONSKIH BIVALIŠČ IZVIRA IZ ZGODNJEGA MOMOYAMA OBDOBJA, IZ KONCA 16. STOLETJA. BESEDA KIVARI (PRAVILO O REZANJU LESA) SE JE PRVIČ POJAVILA V TESARSKEM PRIROČNIKU, V OBLIKI PETIH PAPIRNIH ZVITKOV, IMENOVANIH SHOMEI (LETA 1608). EDEN TEH ZVITKOV, IMENOVAN BANSHO-SHIKI-SHAKU, RAZLAGA SVETO UMETNOST STAVBE

1. IZVOR: MISTIČNO DARILLO BANSHO-SHIKI-SHAKU SHOTOKUJA, PRINCA, VLADARJA (570-621?)
2. POLOŽAJ: ORIENTACIJA STAVBE IN VRAŽEVEN ODNOS DO SONCA, LUNE, VETRA IN VODE
3. OBRED: MOLITVE, BOŽJA SLUŽBA IN PRAZNOVANJA OB RAZLIČNIH STOPNJAH GRADNJE
4. IZVEDBA: MERA, PROPORCIJA, KONSTRUKCIJA IN POSTAVITEV STAVBE

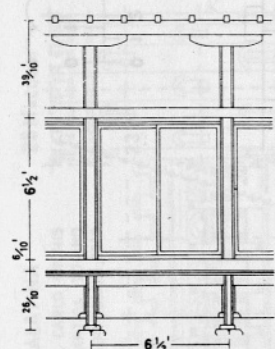
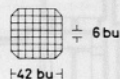
H. ENGEL, THE JAPANESE HOUSE, RUTLAND, VERMONT, TOKYO, JAPAN, 1964



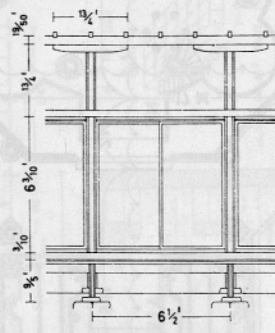
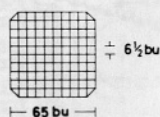
KIVARI MODUL V BANSHO-SHIKI-SHAKU ROKOPISU CELOTNA STAVBA OBSEGA 6×7 KEN ALI 42 TSUBO. ŠIRINA STEBRA JE MODULIRANA S $6 \times 7 = 42$ BU



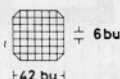
KIVARI MODUL (ZGODNJA OBLIKA) V SHOMEI ROKOPISU



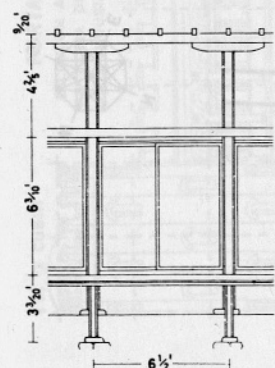
KIVARI MODUL (1608, POZNA OBLIKA) V SHOMEI ROKOPISU LEŠENI DELI POŠA MEZNIH ČLENOV SO MODULIRANI PO GLAVNEM STEBRNEM DELU, KI IZHAJA IZ STEBRNE RAZDALJE V RAZMERJU 1:10



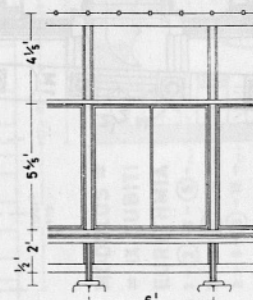
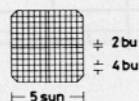
KIVARI MODUL V BUKU -HINAGATA ROKOPISU



1' = 1 SHAKU = 10 SUN = 100 BU = 30,3cm



KIVARI MODUL V KOJO-IN ROKOPISU



SEDANJI KIVARI MODUL V TESARSKEM PRIROČNIKU PROPORCIJE STAVBE SO DOLOČENE S TOČNO MERO, KENOM. OŠNI RAZPON JE $\frac{1}{2}$, 1, $1\frac{1}{2}$, 2 KENA.



STANDARDIZIRANJE SVETLEGA RAZPONA (KYOTO), OZIROMA OSNEGA (EDO) POMENI ZARADI RAZLIČNO MOČNIH SOH SPREMENLJIV OSNI, OZIROMA SVETLI RAZPON.

Illustration 11

The traditional Japanese building components are modular since *ki-va-ri-ho*, or the system of cutting wooden components, was introduced in the 16. century A.D.

The Japanese modular system conforms with the traditional Japanese system of sizes.¹⁵

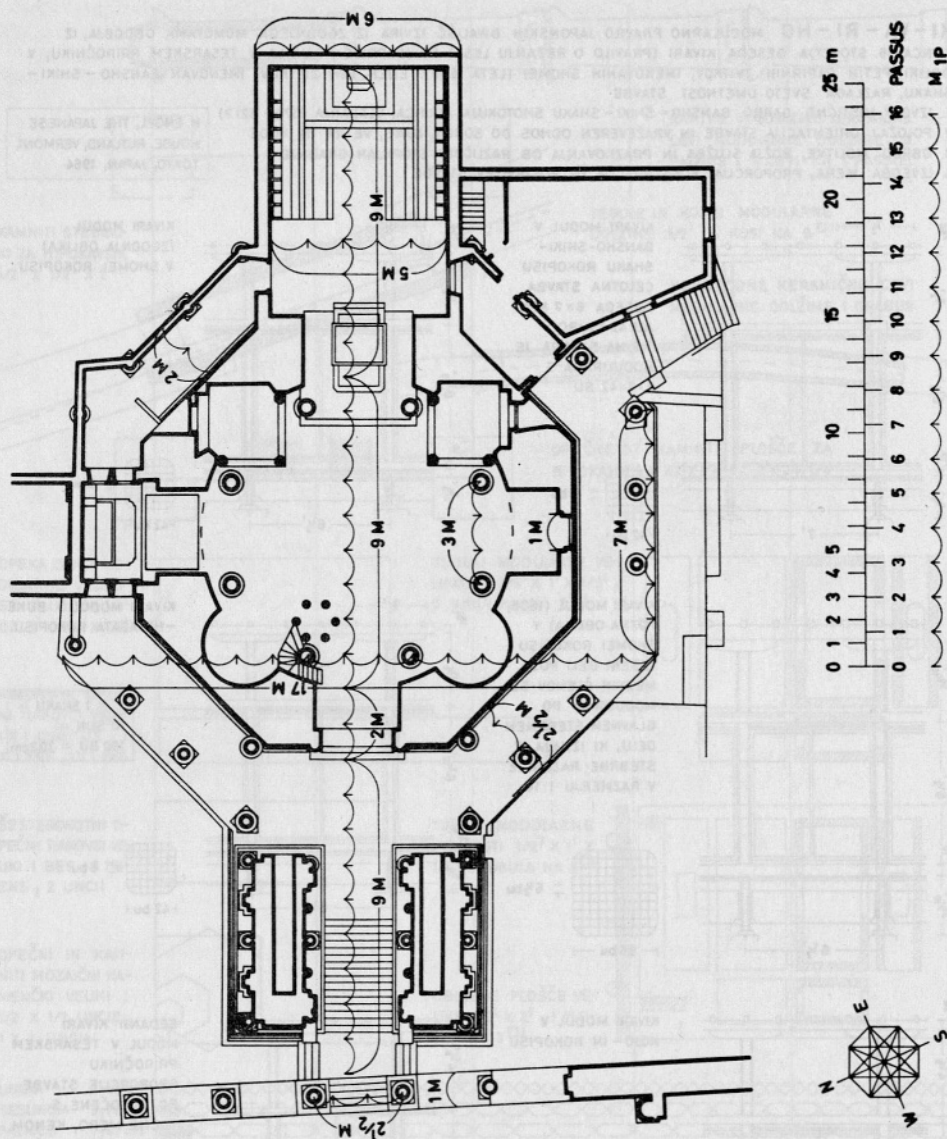


Illustration 12

The Roman buildings are modular. The still standing Diocletian's Mausoleum in Split is a modular composition. On this plan the rhythm of the module, 1 *passus* long, is shown.

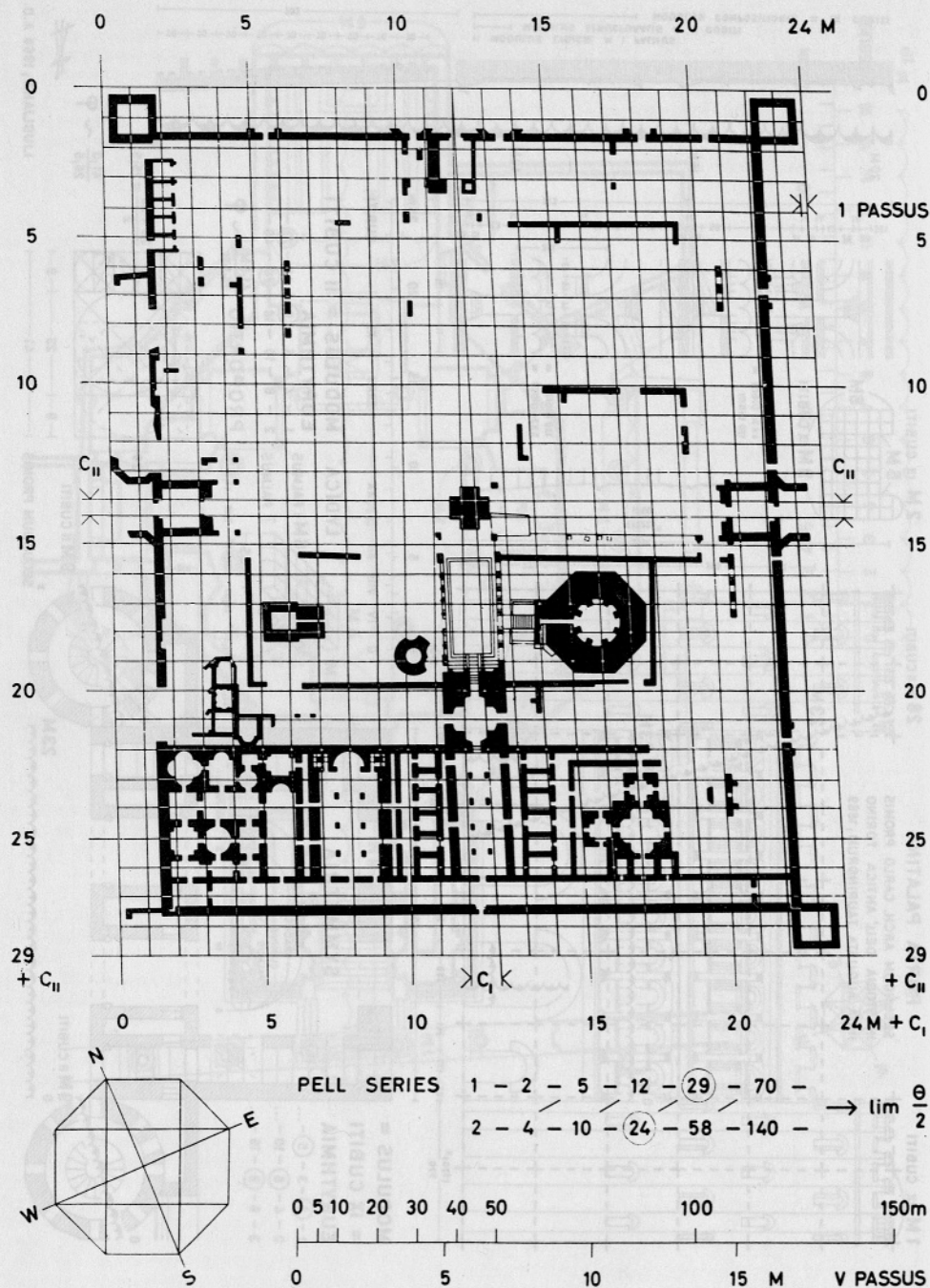
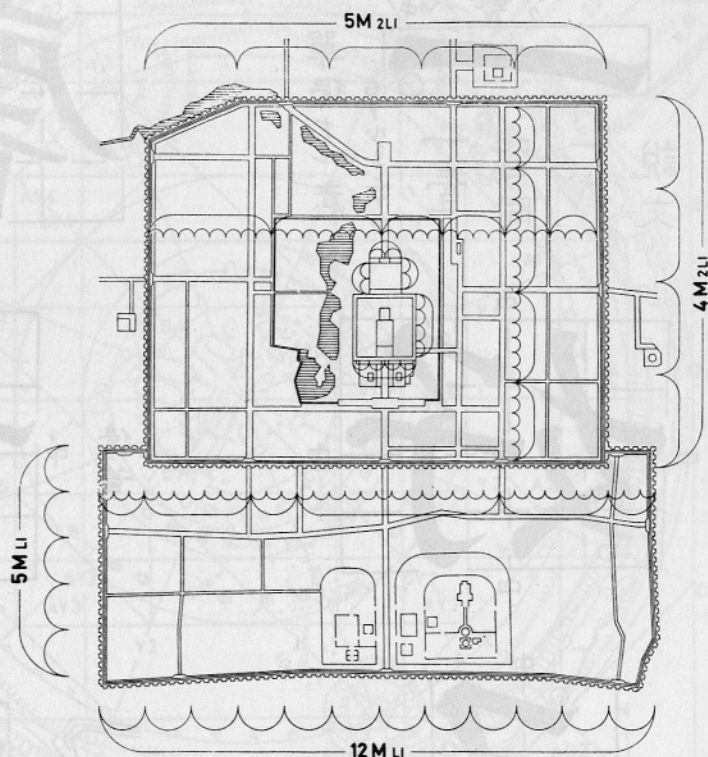


Illustration 14

The Roman buildings and new towns^{11, 12} are modular. The Diocletian's Palace in Split, which is more than mere building and less than a town, is a good example for both. Its plan and elevations are modular.

PEKING, CAPITAL OF CHINA: TARTAR OR INNER CITY XIV. CENTURY A.D.

CHINESE OR OUTER CITY XVI. CENTURY A.D.



MODULES



LI ~ 680m

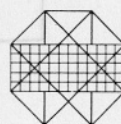
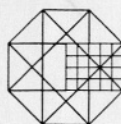
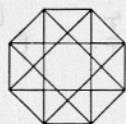
$M_{2LI} = 2M_{LI} = 6M_{\frac{1}{2}LI} = 6M_{60 \text{ CHANG}} = 6M_{100 \text{ KUNG}} = 18M_{\frac{1}{3}LI} = 18M_{20 \text{ CHANG}}$

PROPORTION

1:1 PRIMA

5:4 QUADRIAGON

12:5 DOUBLE QUADRIAGON



EURHYTHMY

1 - 2 - ⑤ - ...
2 - ④ - 10 - ...

$\rightarrow \frac{5}{2} \sim \frac{5}{4} \sim 1,25$

2 - 5 - ⑫ - ...
1 - 2 - ⑤ - ...

$\rightarrow \frac{12}{5} \sim \frac{12}{5} \sim 2,40$

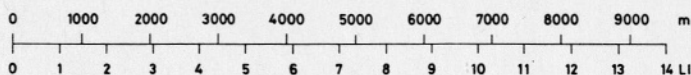


Illustration 15

The modular principle is not restricted only to the Roman architecture. The composition of Peking, the capital of China since the XIV century A.D., conforms with the traditional Chinese standard sizes, used as modules.

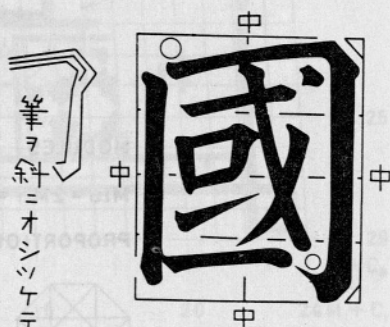
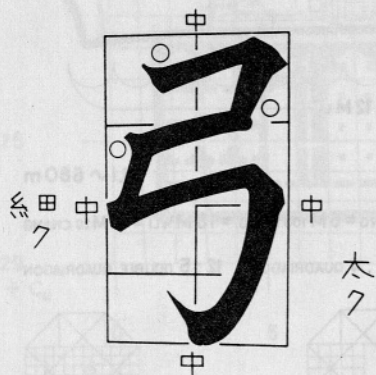
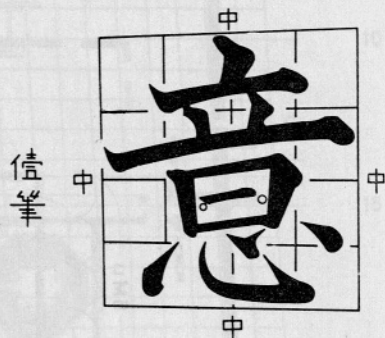
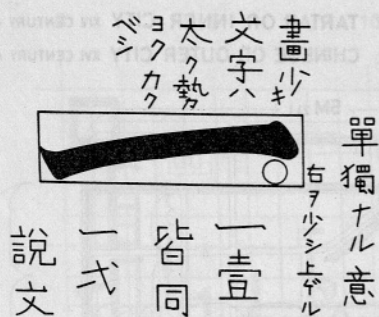


Illustration 16

The modular grid, used as a basis for the Chinese calligraphy, is comparable to the modular principle in design of Roman vases¹⁹ and to the modularity of ikebana, the traditional Japanese flower arrangement.¹⁵

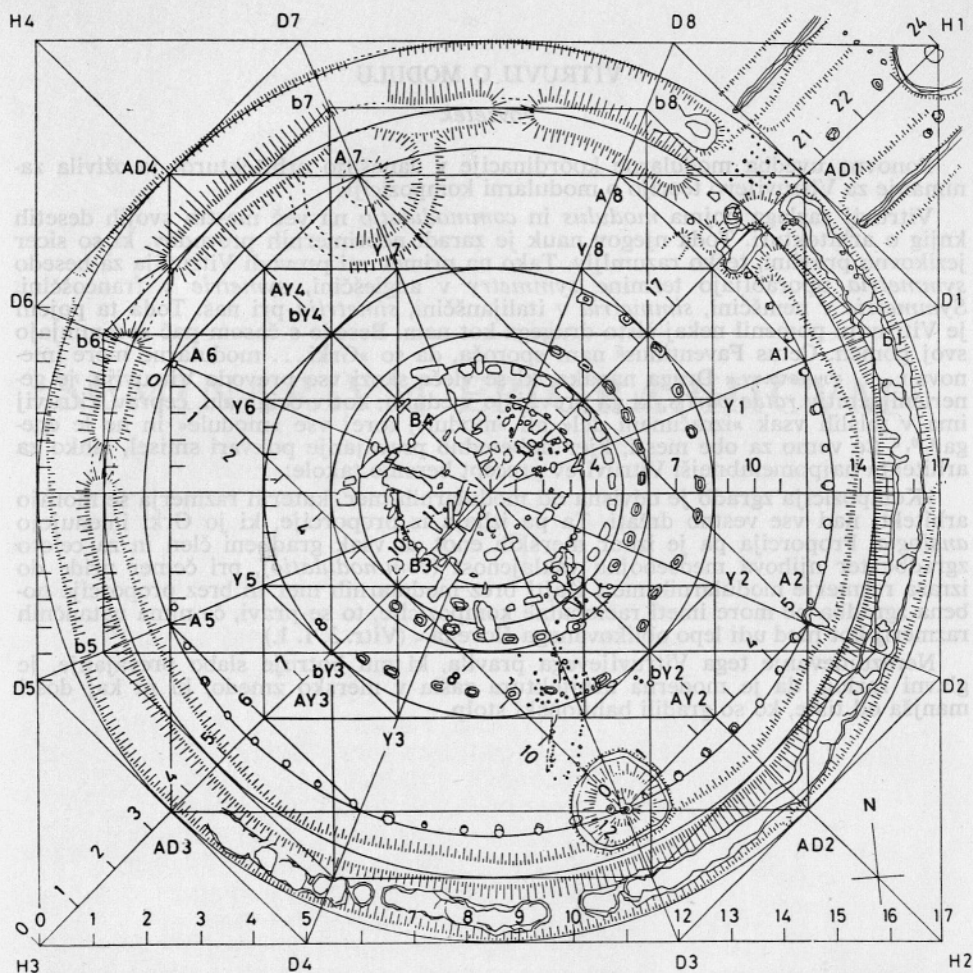


Illustration 17

The composition of Stonehenge, one of the oldest surviving architectural monuments, is modular. Diameters of its circles are in the ratio of 7, 10, 12, 17, 26, 29 and 34, modules.²³

VITRUVIJ O MODULU

Povzetek

Ponovna uvedba modularne koordinacije v današnjo arhitekturo¹ je oživila zanimanje za Vitruvijevo teorijo o modularni kompoziciji.

Vitruvij razlaga pojma *modulus* in *commodulatio* na več mestih svojih desetih knjig o arhitekturi. Toda njegov nauk je zaradi neprimernih prevodov, ki so sicer jezikovno pravilni, težko razumljiv. Tako na primer vsi prevodi Vitruvija za besedo *symmetria* uporabljajo termine *symmetry* v angleščini, *symetrie* v francoščini, *Symmetrie* v nemščini, *simmetria* v italijanščini, *simetrija* pri nas. Toda ta pojem je Vitruviju pomenil nekaj čisto drugega kot nam. Besede s časom pač spreminjajo svoj pomen. Cetus Faventinus⁵ nam sporoča, da so »Grki... modularne mere imenovali... συμμετρίαν.« Druga napaka, ki se vleče skozi vse prevode Vitruvija, je generični genitiv *ratae partis*, ki ga prevajajo v ednini, kot v originalu, čeprav Vitruvij ima v mislih vsak »izračunani del« ali »modul«, torej vse »module« in ne le enega.^{4, 6, 8} Če vemo za obe mesti, kjer dobesedno prevajanje pokvari smisel, lahko za arhitekta najpomembnejši Vitruvijev precept beremo takole:

»Kompozicija zgradb je odvisna od modularnih mer, katerih razmerja se morajo arhitekti nad vse vestno držati. Ta pa izhaja iz proporcije, ki jo Grki imenujejo *analogia*. Proporcija pa je izbor merskih enot za vsak gradbeni člen in za celoto zgradbe ter njihova medsebojna vsklajenost (*commodulatio*), pri čemer pride do izraza razmerje modularnih mer. Kajti brez modularnih mer in brez proporcije nobena zgradba ne more imeti racionalne kompozicije, to se pravi, če nima natančnih razmerij kot med udi lepo oblikovanega človeka.« (Vitr. 3. 1. 1.)

Nerazumevanje tega Vitruvijevega pravila, ki mu botruje slabo prevajanje, je glavni razlog, da je moderna arhitektura zašla v mersko zmedo, ki ni kaj dosti manjša od tiste, ko so gradili babilonski stolp.