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JCO Interviews Dr. Stephen R. Marquardt on the Golden Decagon an Facial Beauty

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DR. GOTTLIEB Steve, you appeared on a recent television documentary series, The Human Face, in a "Beauty", and presented a Golden Decagon mask that you have devised from the Golden Ratio. What is t Ratio?

DR. MARQUARDT The Golden Ratio is a ratio found in nature and design that measures 1:1.618. It ha the Fibonacci Ratio or Phi Ratio and, sometimes, the divine ratio. It is also referred to as the Golden Sect Section.

DR. GOTTLIEB Many historic figures--Pythagoras, Plato, Euclid, da Vinci, Durer, and Mozart, to nam believed the Golden Ratio represented perfect harmony in nature and in design. Is there evidence for sucl phenomenon?

DR. MARQUARDT It does seem to occur throughout nature in many biologic systems, including flowe divergence from a stem in plants, and particularly in humans. For example, the width of the nose to the w mouth is a ratio of 1:1.618 in a beautiful face. In an ideal dentition, the width of the maxillary central inc times the width of the maxillary lateral incisor. In an ideal human body--for example, Leonardo da Vinci Man (or "Man in a Circle")--the distance from the bottom of the foot to the navel is 1.618 times the dista navel to the top of the head, and the distance from the navel to the thyroid cartilage, or Adam's apple, is 1 distance of the thyroid cartilage to the top of the head.

DR. GOTTLIEB You believe there is a mathematical, biological basis for human attractiveness in the C

DR. MARQUARDT A famous platitude is that "beauty is in the eye of the beholder", and to a great exte A man may find a Ferrari automobile extraordinarily beautiful, where a woman might find it very unattra woman might find a particular dress very beautiful, where a man may have totally ambivalent feelings ab other hand, when it comes to facial attractiveness, there does seem to be a universal perception of charac form or shape of the face that are found attractive, and this attractive-face concept seems to be not only u within one culture, but universally cross-cultural, regardless of other parameters, including birth rank, ag This universal perception of attractiveness appears to have a biological basis.

DR. GOTTLIEB Why did you create the Golden Decagon mask?

DR. MARQUARDT I have often been given credit for creating the Golden Decagon mask. However, I r say that I didn't create it, but rather discovered it. We now believe that this mask is an archetypal or instir in our brain which is present before we are born and is with us throughout our lifetime. I originally was l to answer the question, "Is beauty quantifiable?" That is, is there an idealistic or idealized form of the fac universal with regard to a perception of attractiveness? The vast majority of people I questioned regardin felt that beauty was not understandable or quantifiable, and something that we might never really compre degree. However, a few throughout history, including the artist Sir Joshua Reynolds and others, have felt probably is understandable and quantifiable to some extent. The reason I was searching for a quantifiable attractiveness myself was to better understand beauty, because as a facial reconstructive surgeon, a great

surgical skill is used not only to correct functional facial deformities, but also to help correct esthetic defo
Without a clear understanding of what beauty is, it' s very difficult to have an appropriate or meaningful
is correcting an esthetic deformity.

DR. GOTTLIEB That would apply to orthodontists as well.

DR. MARQUARDT Absolutely.

DR. GOTTLIEB How did you develop the mask?

DR. MARQUARDT I began merely studying faces of professional models and movie stars. By virtue of
they get paid for being attractive, they seemed to be a good group to study to ascertain if there were some
theme in attractive faces. I initially studied them with regard to any similarities they might have, and foun
Golden Ratio did seem to occur in the faces of these attractive people much more often than in the faces
attractive individuals. There had been little success in multiple previous attempts to use the Golden Ratio
the attractive face, primarily because no generalized recurrent theme was found in the face.

DR. GOTTLIEB Why was that?

DR. MARQUARDT The big problem was that limited areas of the face could be described in linear fash
carrying a 1:1.618 ratio, but this was all pretty much one-dimensional. No one had ever successfully desc
of the face or the entire face in any way in a two-dimensional configuration. My first major breakthrough
realization that the visual perception of the face is really two-dimensional, and that if there were going to
of a recurring theme in the face that was mathematical, it would most likely be two-dimensional, rather th
dimensional. The simplest configuration that describes the Golden Ratio in two dimensions is an acute G
with sides of 1.618 and a base of 1, or an obtuse Golden Triangle with a base of 1.618 and sides of 1. To
elements form a Golden regular pentagon, and the regular pentagon itself, if duplicated, inverted, and sup
itself, forms the Golden Decagon--a regular vertex radial decagon. I must admit it took quite some time f
to evolve from the Golden Section line into the two-dimensional complex configuration of the Golden D
once that was established, then the rest of the facial configuration was constructed fairly rapidly.

DR. GOTTLIEB For a long time the Golden Divider, which is a double caliper set to the Golden Ratio,
identify Golden relationships. What is the advantage of the mask over the divider?

DR. MARQUARDT The Golden Divider is very helpful to establish and understand linear relationships
understand twodimensional Phi harmony and Phi relationships, particularly in a face, it' s necessary to u
or at the very least the Phi decagon, which is the ultimate representation of the Phi Ratio as it occurs in th
dimensions.

DR. GOTTLIEB Are you developing a three-dimensional mask?

DR. MARQUARDT We are actually working on constructing the 3D versions of the masks at this time.
repose and smiling expressions, we already have the mask in two views (frontal and lateral). With two vi
object you can construct the third view, and with all three views you can construct a three-dimensional m
the two views of each expression already defined, we are well on our way to the 3D construction.

DR. GOTTLIEB One of the intriguing things about the Golden Decagon matrix is its relationship to DN
say, the Golden Ratio is in the DNA structure, are the beauty and harmony in nature, including the structu
human body and face, genetically determined according to the Golden Ratio?

DR. MARQUARDT As can be seen on our website, www.beautyanalysis.com, the Golden Decagon cor fairly complex geometrically, and the DNA molecule (particularly the "B" DNA molecule, which is the r DNA seen in biologic systems) in cross-section exactly matches the Golden Decagon geometric configur This is probably because the DNA, needing to replicate itself by increasing in size at a constant ratio, ad without deviation, appears to call upon the mathematics of the Golden Section, which itself is the only m configuration that can duplicate itself ad infinitum without variance. Because both the DNA molecule an Decagon have this property, this is the most likely reason that the DNA follows the Golden Section geom research we' ve done so far seems to strongly indicate that the DNA structure, which is the determinant face construction, is built upon the Decagon complex, which in turn is built upon Phi or the Golden Secti feel that the Phi mask or Golden mask is a genetically encoded configuration or archetype which is basic in our genetic material and passed on from generation to generation for recognition of our own species.

DR. GOTTLIEB Is it science fiction to think that some of the more serious departures from facial and b and harmony may be improved with DNA modification?

DR. MARQUARDT DNA is the basis for all life. It is the source code from which we, and everything w made. Our body' s potentially ideal form and function are a product of our DNA, and likewise our body' and abnormal functions are frequently a function of our own DNA. Since our DNA is the source code of with greater control of our DNA through its purposeful modification, we should ultimately be able to cor functions and anatomic configurations that DNA is responsible for manipulating and constructing.

DR. GOTTLIEB You have developed both frontal and lateral versions of the mask, as well as smiling o you show us those?

DR. MARQUARDT Here you can see both the frontal and lateral versions of the mask, in repose (Fig. 2 smiling (Fig. 2B).

DR. GOTTLIEB How should the masks be used?

DR. MARQUARDT The mask really describes the idealized form of the face. The ideal size of the face approximately 1/7 to 1/8 of body height, which has been known since the first Greek sculptors presented and has been used ever since. On the other hand, there has never been a clear understanding or any quant ideal shape or form of the face or its components, including the nose, eyes, lips, etc. I believe these mask the first concept that truly mathematically quantifies the idealized face and its frontal and lateral views, b and smiling.

DR. GOTTLIEB How do you then apply that information?

DR. MARQUARDT The application for this information or technology would be in any area where idea configurations are important, whether it be in medicine, in surgical applications of reconstructive proced face; in orthodontics, for diagnosing variations from ideal and treatment planning their corrections; in art painting or sculpture; and in the graphic arts, to modify and adjust faces to increase their visual perceptio attractiveness. Additionally, the technology can be used in per- sonal identification and security programs face could be compared to the mask and this comparison used as a unique personal "fingerprint" of the in face. Even genetically identical twins, under close analysis, have slight variances in their facial configura are quite a few other applications, including biology, psychology, and anthropology, but these are some o ones.

DR. GOTTLIEB Does the Golden Decagon apply to the faces of children?

DR. MARQUARDT The Golden Decagon mask that has been presented at this point is that of the post-p female adult, ranging from about 14 to 24 years of age. There is a mask for the young child, and it is som slight variation from the post-pubescent adult mask, but is distinctly different in several ways. As anybod of child development can attest, the face distinctly changes between the ages of approximately 2 and 14. child between the ages of approximately 6 months and 2 years has a high degree of attraction for adults f purposes of creating a nurturing behavior in adults toward that child. As the child increases in age, the fa less like that face, becoming relatively less attractive with age. For example, a 2-year-old is generally fou attractive than a 4-year-old. Most 4-yearolds are found to be more attractive than 6-yearolds, most 6-year attractive than 8- year-olds, and most 8-year-olds more attractive than 10- or 11-year-olds. At this point, attractiveness changes, and between the ages of approximately 11 and 14, the attractiveness increases tre 14, the face has metamorphosed into that of the pubescent adult. This matured face is generally quite attr nurturing way for parents, but in a sexual attraction way for a mate. So while the mask of the child age 6 years is significantly different from that of the post-pubescent adult, both are highly attractive, but in very ways for their different biological purposes.

DR. GOTTLIEB Does the concept of beauty change in the adult aging process?

DR. MARQUARDT At about age 24, the postpubescent adult face begins to slowly and progressively b attractive year after year from that point forward. It is interesting to note here that the face of the female b progressively less attractive at a greater rate than does the face of the human male. In other words, the hu attractiveness maintains longer than the female' s attractiveness. Although the human male is not genera to be as attractive during the post-pubescent period as the female, he does maintain his attractiveness to a degree for a longer period of time.

DR. GOTTLIEB Some orthodontists believe in very early treatment of certain conditions, at 3 to 6 year cases may be started from 6 to 9, while a majority are probably started between 9 and 12 years of age. Do know about the development of the face encourage or discourage certain orthodontic treatment changes a

DR. MARQUARDT The ultimate goals of orthodontic treatment are the idealization of the occlusion an possible, the simultaneous positive influence on the facial attractiveness of the patient. Regardless of the the patient starts treatment, these should be the primary concerns. With respect to the mask, anything tha orthodontist can do to "guide" the patient' s facial components into a high correlation with the mask will final esthetic outcome of treatment. It should be remembered that the mask is that of the face of the postp adult, so the goal of the orthodontist, with respect to esthetics, would be to treat the child' s face so that i an attractive young adult face--in other words, has a high correlation to the mask.

DR. GOTTLIEB There must be examples of faces generally accepted as beautiful that do not exactly fit

DR. MARQUARDT No biological configuration of the face that occurs naturally fits the mask exactly, mask is a geometrically perfect configuration, and biological systems are never geometrically perfect. Al come extremely close, none are exactly mathematically precise. However, in my experience, the more a f be subjectively attractive by human examiners, the more closely it will fit the mask. Conversely, the less face is, the less it will fit the mask. It is important to note, however, that most faces do fit the mask quite a face that is considered somewhat plain will have a significant correlation with the mask. The difference plain face and a beautiful face is just a matter of a few millimeters in different areas--nothing as extraord as one might expect. It' s not until faces are perceived to be fairly unattractive that they begin to deviate

significantly. This is pretty clear on our website under the section "Beauty Ranges". On the site you' ll fi tremendous amount of information on our research and on the concept of beauty ranges.

DR. GOTTLIEB Concepts of facial beauty seem to vary with time and among races. How does that squ concept of the Golden Decagon mask?

DR. MARQUARDT Concepts of facial beauty have been thought to vary with time and among races, bu shows that this is not particularly true. The mask' s correlation with attractive faces throughout history s consistent. There are slight variances between the races with regard to the mask, but this variance is also throughout time. Again, on our website, www.beautyanalysis.com, under the section "Beauty Through H as far back as Queen Nefertiti are analyzed using the mask. Beautiful faces extending through the Greek periods, late Egyptian, Renaissance, post-Renaissance, Baroque, precontemporary and contemporary are exhibiting a high correlation with the mask (Figs. 3A, 3B). This is pretty clear evidence that the mask ap consistently fit attractive faces throughout history.

DR. GOTTLIEB There has been some discussion in dental esthetics about symmetry vs. balance. Some perfect symmetry is not beautiful. Do you agree with that concept?

DR. MARQUARDT Terms like "symmetry", "balance", and "harmony" have been used over and over a much distinction for their actual definitions. Symmetry can be defined as mirror imaging about an axis. E equality of magnitudes on either side of a division. So from this definition, we can see that absolute sym have balance, but balance wouldn' t necessarily have symmetry. Harmony, on the other hand, is the pres recurring themes within an entity. Probably the term that' s been equated most commonly with beauty is has been said that perfect symmetry is perfect beauty. It is true that an attractive face is relatively symme doesn' t mean that a symmetric face is necessarily attractive. For example, a face like Paulina Porizkova' of this issue, is quite symmetric and quite beautiful at the same time. On the other hand, if you take a fac E. Neuman' s from Mad magazine and make it perfectly symmetric, he doesn' t become Paul Newman, symmetric Alfred E. Neuman. So symmetry doesn' t necessarily predict attractiveness. A face doesn' t h exactly perfect symmetry to be beautiful, but symmetry is an important factor, and there must be a good symmetry for a face to be beautiful.

DR. GOTTLIEB Why is the smiling mask more attractive than the repose mask?

DR. MARQUARDT The smiling face has historically been considered more attractive than the repose fa all cultures. The smiling mask actually contains significantly more of the Golden Decagon elements than the repose mask. This appears to be the reason that we find the smiling mask more attractive. The greate Golden Decagon elements used in the construction of a facial configuration or expression, the more attra will appear to humans.

DR. GOTTLIEB What part do the teeth play in the smiling version of the mask?

DR. MARQUARDT When one smiles, the geometric or mathematic center of the face is not the geogra the face. The face is constructed of multiple Decagon complexes which pretty much descend to the mou the teeth, so when one smiles, the center of attraction of the face is actually the smile. This includes the li and their contents, particularly the maxillary anterior teeth. Since the maxillary central incisors and the la are the center of the smile, one could actually say that the anterior maxillary teeth are really the center of elements in the face.

DR. GOTTLIEB So some elements of the face are more critical than others?

DR. MARQUARDT The perception of the face is predicated on recognition of the different subcompon face. The most important parts for facial recognition are contained within what is referred to as the "Inter This is a triangle from the eyebrows to the chin--specifically, one encircling the eyebrows and extending chin with the point downward at the chin. Contained within this Internal Triangle are the eyebrows, the e the lips, and the chin. These elements are actually the critical elements in facial recognition. The cheeks, the hairline, etc., contained outside of the Internal Triangle are secondary elements and are not as importa elements within the Internal Triangle for facial recognition and the perception of attractiveness.

DR. GOTTLIEB Can you picture ways in which an orthodontist could use the Golden Decagon mask?

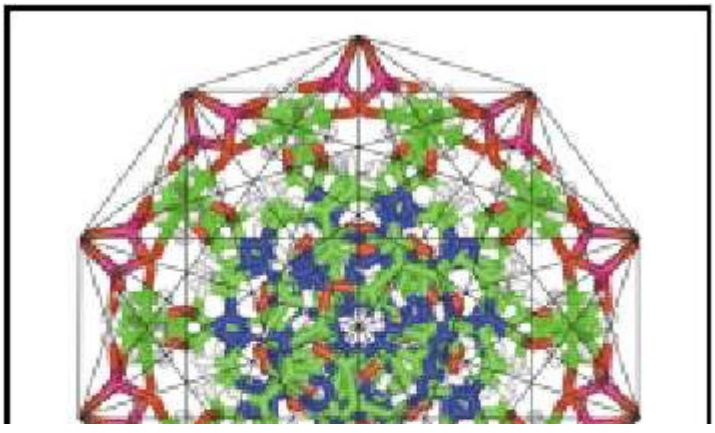
DR. MARQUARDT The orthodontist can use the mask as a paradigm of the ideal, final esthetic result. I orthodontist can change or modify the esthetics with treatment, he or she should be cognizant of the chan to bring the facial soft tissues into as close an alignment with the mask as possible to effect an ideal esthe functional, result. Treatment planning using growth forecasts and facial analyses are critical when treatin they mature into the young adult stage of their life, and having an idealized goal such as the mask to treat believe, would give much more consistent and esthetic results at the end of treatment than is currently po

DR. GOTTLIEB Could children in an orthodontic practice use the mask to explore aspects of their own

DR. MARQUARDT Children can certainly apply the mask to their faces to explore the correlation of th the mask, but it is unfair to judge a child' s attractiveness or future attractiveness by applying the mask to child, due to the variation of growth patterns and inconsistency of facial growth from one child to anothe children do not match the mask particularly well before they are 14 or more years of age. I think after tha however, the mask is a significant way for pubescent young adults to analyze their faces, and a guide for orthodontist in deciding on a treatment plan that will effect the most positive esthetic change for them. In believe that growth forecasting before the age of 14 may be a valuable aid in helping the orthodontist det closely the child' s face, with normal growth, might potentially match the mask by the time they are a yo this information, the orthodontist can make necessary corrections to guide growth into a configuration tha the mask as closely as possible by young adulthood. This is particularly true when surgery is contemplate orthodontic therapy.

DR. GOTTLIEB Thank you, Steve, for giving our readers a fascinating insight into the ingredients of hu beauty. •

FIGURES



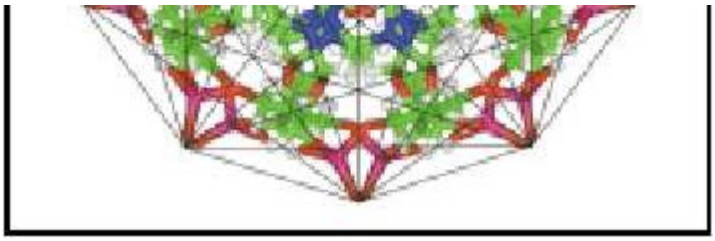


Fig. 1 Fig. 1 Golden Decagon (black) overlaid on cross-section of B-DNA molecule (color).

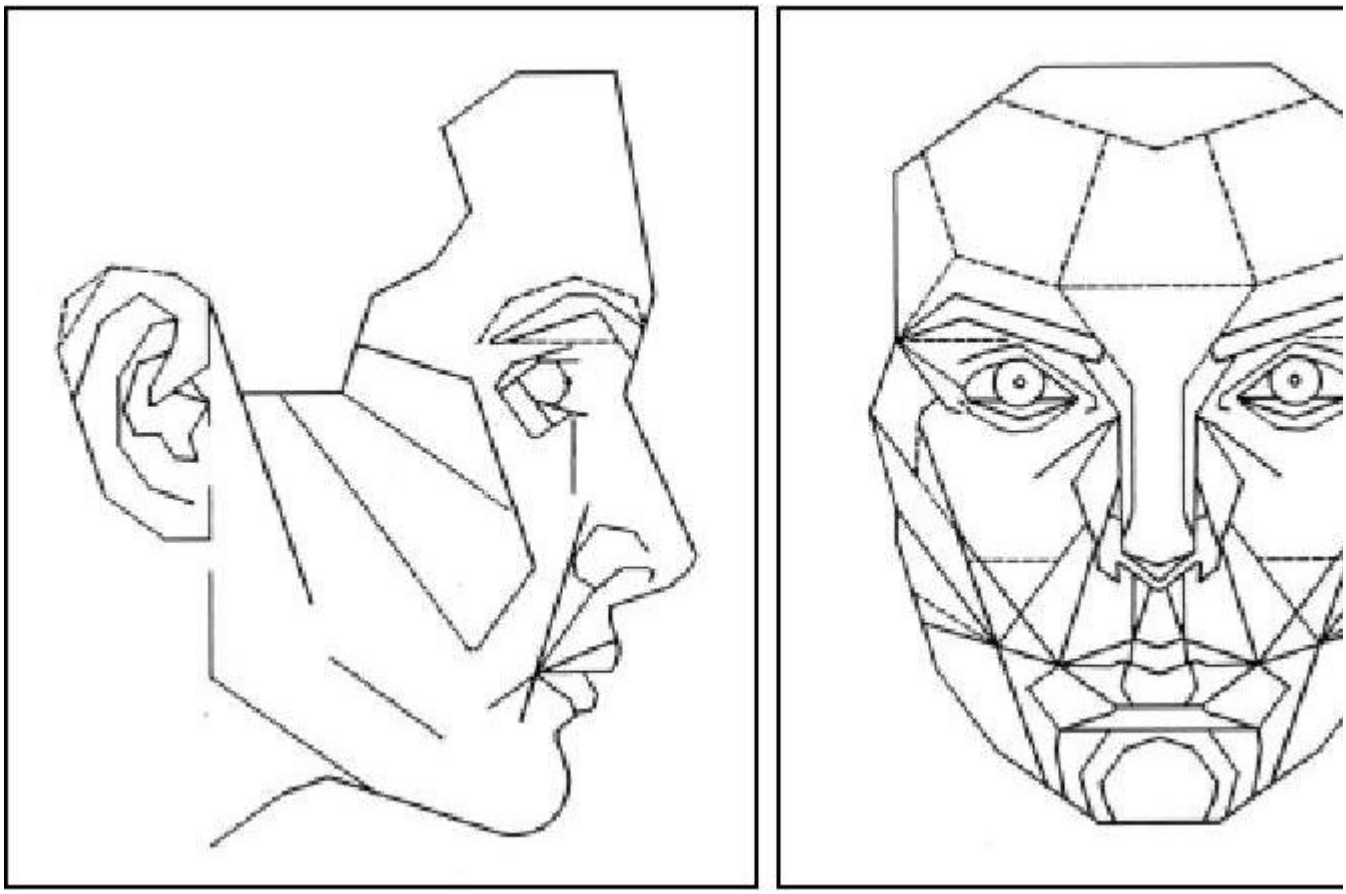
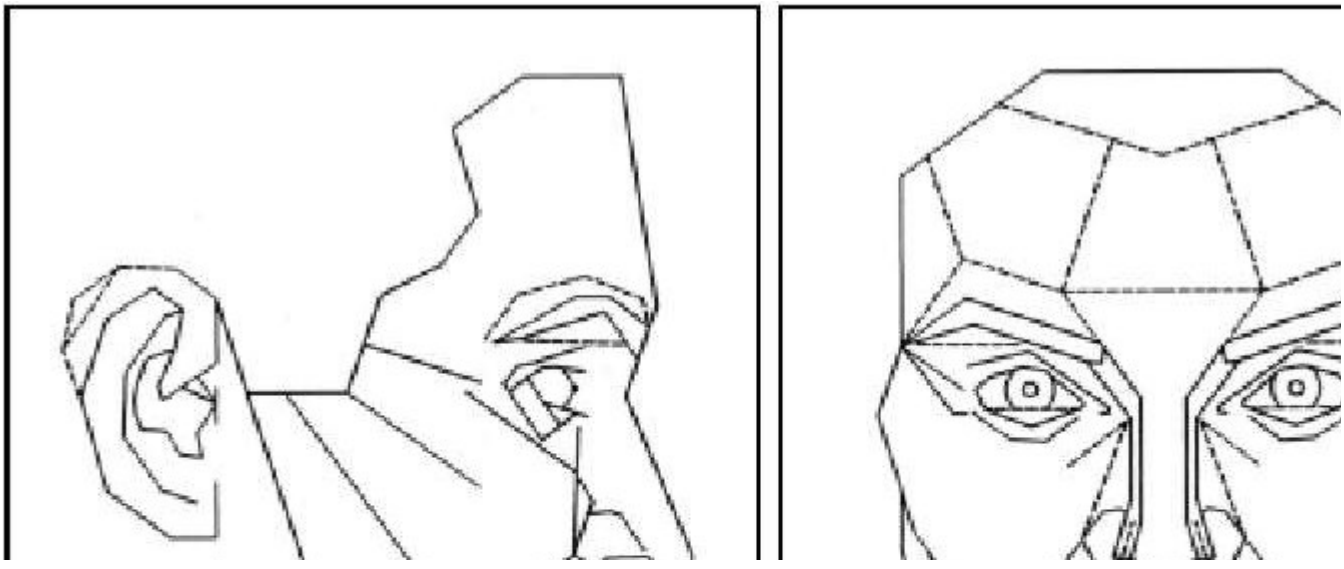


Fig. 2A Golden Decagon masks (repose).



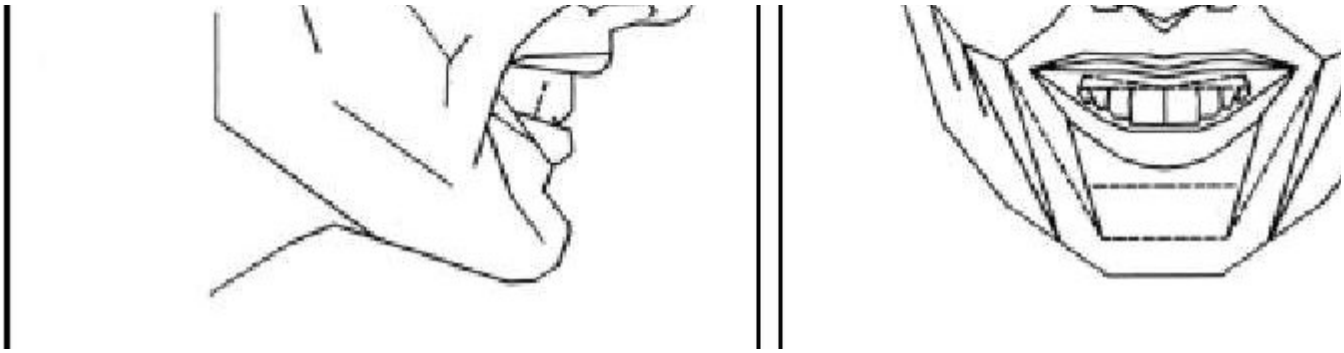


Fig. 2B Golden Decagon masks (smiling).

Fig. 3A Application of Golden Decagon mask to historical concepts of facial beauty. A. Venus, c. 164-1
courtesy Toledo Museum of Art, Toledo, OH.

Fig. 3B Application of Golden Decagon mask to historical concepts of facial beauty. B. Detail from Port
Barrett Moulton by Sir Thomas Lawrence, 1794, courtesy Huntington Library, Art Collections and Botar
San Marino, CA.