Facing fitness

Does asymmetrical posing in portraits reflect fitness?

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RuG

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Abstract

Cerebral lateralization is the specialization of one cerebral halve to perform a set of tasks that is not present in the other halve. Cerebral lateralization also accounts for motor asymmetries such as those in facial expressions. It is well known that the left facial halve is perceived as more emotionally expressed. This is caused by the quicker and stronger expression of emotions on this side of the face because the right hemisphere is usually specialised in 'emotions' and the hemispheres control the motor responses of the contralateral side of the body. The differences in facial asymmetry account for various differences in posing behaviour. In normal portraits of people a leftward bias is observed and thought to exist because normally you want to pose in such a way that your emotional side is visible. But in portraits of university professors a rightward bias is observed, leading to the thought that scientists are more likely to show their rational (non-emotional), 'scientific' right side. The existence of lateralization suggests that there are fitness advantages to lateralization. I investigated the relationship between laterality in posing bias and fitness components in a database containing portraits of Dutch politicians as well as fitness measurements such as longevity, number of children etc. Firstly a leftward bias in portraits was observed, suggesting that politicians also want to show their emotional side to the observer. Secondly I found that Dutch politicians had a very high average longevity, showing their high socio-economic status. Thirdly, the data showed that from which side the lighting came from had a positive effect on which cheek was shown more pronounced. Fourthly, ministers had a lower proportion of rightward portraits and in general the rightward bias increased in time. With respect to fitness models posing with their left eye higher had a greater chance of being unmarried and longevity had a positive correlation with the midpoint of their active carreer and being a minister, but there was no relation with laterality in posing.

1 Cerebral lateralization

Cerebral lateralization in humans is well known in several different fields of study, from behavioural biology to (neuro)psychology. Cerebral or brain lateralization is defined as the asymmetry in morphology and function of the two hemispheres: '*A longitudinal fissure separates the human brain into two distinct cerebral hemispheres, connected by the corpus callosum. The sides resemble each other and each hemisphere's structure is generally mirrored by the other side. Yet despite the strong similarities, the functions of each cortical hemisphere are different'* [3]. That hemispheres specialize in function is very clearly visible in the phenomena of right- & left-handedness and of right & left ear preference. However, not all brains are equally organized with respect to left and right differences, that is a person's preferred hand for performing fine motor skills for example is not a clear indication of the location of other brain functions. Although 95% of right-handed people have left-hemisphere dominance for language, only 18.8% of left-handed people have right-hemisphere dominance for language function. Additionally, 19.8% of the left-handed have bilateral language functions [4]. Despite a globally similar organization with respect to the location of functions across species [2], there is substantial individual variation in the asymmetrical organization of the brain, or at least in the perceptual and motor output parts measured in behavioural testing.

1.1 The discovery of lateralization

The early wave of interest in cerebral lateralization started with the discovery of Broca in the 1860s. He directly linked aphasia to brain damage (via post-mortem observations) in the left hemisphere in two of his patients. He claimed therefore that language was located in the left hemisphere. This was more or less already claimed by Dr. Dax half a century earlier. He noted that speech problems in soldiers were more likely to be associated with damage to the left part of their skull (due to sabre blows) than with damage to the right part of the skull [5]. Interest in the subject peaked again after Sperry's discovery of the dual brain in the 1960s [2]. The dual brain theory states that the both hemispheres of the brain may sense and react independently from each other and therefore one halve can dominate another. This discovery could be made because patients with severe forms of epilepsy underwent corpus callosotomy, partly cutting of the corpus callosum, in order to reduce the risk of injuries due to epileptic attacks

1.2 Lateralization in the vertebrate kingdom

Most of the research in the early days was done in laboratories and mostly on humans, because the believe was that only the complex brain of humans was capable of producing language, a faculty so complex that it would take up a large part of the brain and therefore it was lateralised. Even after the discovery of cerebral lateralization in other species, ranging from fish to primates in morphology, perception & behaviour, the research largely remained outside behavioural biology and other species than humans. Moreover the communication between the different fields of research was lacking and the interests of other disciplines had different priorities. The change in the way of thinking came in the past few decades, because in many studies there was evidence for lateral biases affecting everyday behaviour in the natural environment in lots of different species [2]. Some examples of these biases in everyday behaviour in animals are predator and food responses. Generally the right hemisphere is more likely to be specialized in the predator escape and associated fear

reactions. What has to be considered is that the brain halves are contralateral, the left facial hemifield projects to the right brain halve. This one hundred percent contralaterality is not present in all species and all functions but it is the case for viewing projection in birds and fish, in humans however the left side of the retina projects to the left side of the brain and the right side of the retina to the right side of the brain.

Several researches support the claim for predator escape being lateralized in the right hemisphere, toads for example are more likely to react by jumping away when a simulated predator is introduced to the left hemifield of the animal [6]. The same result has been found in stripe-faced dunnart (*Sminthopsis macroura*), a small termite eating Australian marsupial [7], suggesting in some extent universal lateralization of predator response to exist in a variety of species. There is also evidence from lateralization of the food responses of toads. Toads strike, in contrast to their predator response, preferentially prey to their right side [8], which indicates that the left hemisphere (and therefore the right hemifield) is where the food responses are located. This lateralization of the right hemifield for feeding responses was also found in a variety of birds, for example the pigeon[9]. And this has even been traced back to an appearance during evolution as early as teleost fish[10]. For more examples of lateralized functions of the brain, see table 1. The long ongoing existence in a wide variety of species indicates that 1) lateralization is basic to the blue print of vertebrates and that 2) lateralization in a way has to be advantageous, or else evolution would have selected against lateralization, driving it to extinction.

1.3 Development of lateralization

How lateralization exactly develops is largely unknown. However several factors are important. Human handedness (and perhaps handedness in other primates, which is much less pronounced than in humans) for example seems to have a strong genetic background[11]. Next to genetic factors environmental factors are known to influence lateralization. Most notably: the effect of light on the strength and direction of lateralization in birds[12]. The placement of the unborn chick in the egg plays an important role to which side the chick is lateralized. Because unborn chicks are positioned in the egg with one eye to the shell and one eye directly to the body. Therefore one eye is receptable to light and the other one is not. Light that passes the translucent egg shell stimulates

Table 1: some examples of different kinds of lateralized functions with their respective brain halve[2]

Left Hemisphere	Right Hemisphere
Prey discrimination and catching (fish, toads) Foraging with discrimination and/or manipulation of food items (birds) Approach and manipulation of objects (birds, monkeys, apes)	Predator detection (fish, chicks) Predator escape (frog tadpoles, fish, toads, chicks, dunnarts) Neurochemical changes with predator stress (rats, cats) Avoidance/withdrawal (monkeys, apes, humans)
Inhibition of aggression (chicks, humans) Inhibition of intense emotions, especially negative emotions (humans)	Fear (chicks, rats) Aggression (toads, lizards, chicks, monkeys) Courtship and copulatory behavior (newts, birds) Expression of intense emotions (monkeys, apes, humans)
Recognition of categories/attention to large changes (birds, rats) Recognition of species-typical vocalizations (birds, mice, some monkeys, humans for speech)	Contact/monitoring of conspecifics (fish, tadpoles) Recognition/analysis of faces (sheep, monkeys, humans) Recognition of individual conspecifics (chicks)
Attention to landmarks (birds) Attention to local cues (birds, monkeys, humans)	Spatial cognition (birds, rats, humans) Attention to global cues (chicks, monkeys, humans)
Considered responses: *Able to inhibit responding while deciding between alternative responses* *Visuo-spatial analysis centered on local features*	*Rapid, species-typical responses. Visuo-spatial analysis centered on relational properties of the spatial layout*

the growth of the receiving eye to the contralateral hemisphere (unlike mammals, bird have almost complete cross-over off the visual projections) and this 'induces' lateralization of function in the domain of visually guided behaviours[12]. In nature most of the chicks that are still in the egg have their right eye against the shell. In only 1-15% of the cases the chicks are positioned so that the other eye is laying against the shell, which lateralizes the bird in exactly the opposite way. However, due to this turning bias population level lateralization can occur.
There is also evidence for important hormonal influences in the lateralization process, this has been found in mammals and other species[13], but not always in a consistent way and experimental evidence is still scarce. Another important influence is social 'pressure' or social factors that may influence laterality. Left handed-humans have long been forced to write with the right hand, but also in scholing fish population lateralization occurs more frequently than in non schooling fish [14]. Recently there has been some evidence that chicks housed in peer groups, adopt a more similar lateralization bias compared to chicks from other groups (Riedstra in prep.)

1.4 The advantages of lateralization

One of the hypothesis for the existence of cerebral lateralization is that the specialization of one halve of the brain is functionally advantageous. Lateralization can for instance be advantageous because it allows evolution of the brain in such a way that 'useless' duplicates in both brain hemispheres can be minimized. If there are no 'useless' duplicates there is more space for other functions and it can also bring down the amount of brain that is used, although damage to a function cannot be compensated for by the same function in the opposite hemisphere (see below). Another advantage is becoming faster by specializing one hemisphere for a set of similar tasks and try to avoid the slow interhemispheric communication trough the *corpus callosum*. The greater speed can be achieved by the specialization itself and by a faster communication within the same hemisphere, therefore one hemisphere has to be dominant over the other in certain tasks. This specialization can also achieve that functions that cannot be united are processed in different hemispheres, avoiding interaction of these two. The third advantage is that an individual is possibly better at multitasking and parallel processing when at least these different tasks are processed by the two different hemispheres.

It is very difficult to 1) experimentally test these hypothesis and 2) find experimental evidence on the evolution of lateralisation, nevertheless there is evidence for the dual task/parallel processing hypothesis in research done on an invertebrate species, the fruitfly[15]. It was found that fruitflies with asymmetrical brain structures have superior ability to form long-term memory, compared to fruitflies that did not have asymmetrical brain structures. This shows that the lateralization of the two brain halves could be a way to increase neural capacity and therefore increase 'storage room' for long term memory for instance. As already mentioned it has also been argued that cerebral lateralization has evolved as a way to separate incompatible functions[16]. This is the case for animals that have laterally placed eyes, where they have little overlap in viewing projections. Rogers (2000) put chicks on a dual task, one involving the left hemisphere in control of pecking responses and the other involving the right hemisphere in monitoring overhead projections to detect a model predator. The chicks were separated in two groups; one group was incubated in the dark (so weakly lateralized) and the other group was incubated in the light (so strongly lateralized). She showed that the strongly lateralized chicks detected the model predator sooner than did the weakly lateralized chicks, at least with the left eye.

This suggest that lateralization enhances performance by processing data in two hemispheres. This result also came forward in the other tests, the strongly lateralized chicks were far better in discriminating grain versus pebbles and learned faster to avoid pebbles and peck more frequently at grain. But this result only occurred when the overhead projector showed a model predator, increasing the thought that lateralization is very important to perform dual tasks and separate incompatible functions like left and right eye fields in species with laterally placed eyes.

1.5 The disadvantages of lateralization

The existence of such population lateralization bias is very puzzling, because lateralization can exist only when the advantages outweigh the disadvantages it posses to an individual organism. And there are certainly some clear disadvantages to cerebral lateralization[17] which can be exploited by other organisms: 1) behaviour becomes predictable, and 2) as mentioned above damage sustained to functions located in one hemisphere can not be compensated for by the other hemisphere. The latter disadvantage is not easily overcome, however the former might not be very disadvantageous in a social context. If for example an organism is lateralized on his left hemifield for predator response and is more likely to react when the predator gets in his left hemifield than a predator appearing in the right hemifield has a great advantage. And because in nature predators appear on the left and right at random lateralization would be very disadvantageous in this case. On the other hand, if a predator is lateralized in the same way and a prey can predict on which side it can avoid predation than it would be very disadvantageous for the predator.

But now imagine an individual that is strongly lateralised in its behaviour, when this individual is preyed upon the laterality of the escape response (S-startle in fish) it self may be more successful than a non-lateralised escape response, but the predictability of its behaviour may be advantageous to the predator, however, when such an individual is in a large school (or flock) with all the other individuals being lateralised in a similar direction this predictability of behaviour results in a higher integrity of the flock which might be disadvantageous to a predator. This is very possible the case in fish (see Bisazza et al. 2000) .

Therefore it would seem likely that there is a dynamic relationship between lateralized behaviour in interacting asymmetric organisms[2].

1.6 Why does lateralization exist?

Lateralization is often found in populations, but the direction of lateralization differs almost always from a 50/50 ratio. In humans for example, the inheritance of handedness fits a one locus model [9] (although this is highly debated) where one allele causes right handedness and where another allele causes left- or right handedness at random[18]. This mechanism could in theory lead to any proportion of right handers between 50 and 100%, and if handedness were selectively neutral, there would be expected to observe on of these extremes (because of loss of one allele by genetic drift). However in human populations a rather stable proportion of ca. 85% right handers is observed[19]. So why is there not a full one hundred percent bias for the lateralization to one side?

The population structure in which lateralization exists, where the lateral biases are present in most of the organisms in the population, suggest that lateralization may have evolved to be an evolutionary stable strategy (ESS)[20] to coordinate lateralization behaviour. The theory of the ESS suggests that there is a strategy that has been accepted by most of the organisms in a group and where there is no room for another strategy. Deviation from this evolutionary stable strategy by an individual only results in the loss of fitness

and can therefore not be replaced. Ghirlanda (2004) showed that a population lateralization where most of the organisms are lateralized in the same way, which is the case in most vertebrates, can be evolutionary stable if being lateralized in one or the other direction has frequency-dependent costs and benefits. Being lateralized in the most common way may account for the dilution effect if a group attacked by a predator all go in the same direction. On the other hand the predator may also go this way and therefore there are also costs to this side. The inequality in lateralization may therefore be stable if there is a frequency dependent selection pressure on being the most or less common strategy[19]. Another possibility for the existence of cerebral lateralization is that the advantages outweigh and counteract the obvious disadvantages.

2 Lateralization of facial expression

'We respond to gestures…in accordance with an elaborate and secret code that is written nowhere, known by none and understood by all'[21]. This sentence shows that lateralization can also be looked at in a social context other than that of predator and food responses. In a social context there is frequent communication in various and different ways. The verbal channel of communication can sometimes account for a lot of misunderstandings and is therefore a poor medium for the expression of emotions in different social situations. It is well known that humans communicate a lot with facial expressions, and these expressions are as mentioned often very universal. But despite the universality, within a person the both facial halves convey different messages, because of their asymmetry. It has been found that the right side of the brain houses most of our emotional 'capacity', this side of the brain controls the left side of the motor output; therefore the left cheek of the face expresses emotions quicker and more intense than does the right cheek. In daily situations people tend to know how to use this 'secret code' of facial expression by intuition. This is used in both directions of signalling, as well in the perception as in the sending of signals[1, 12, 22-26]. There is little known about what groups of people tend to show which halve of their face in a certain context. Research shows that in normal everyday photos the left halve of the face is overrepresented[24] and that in paintings of professors of Dutch universities the right halve of the face is overrepresented[1]. As already mentioned the existence of lateralization shows that there must be fitness advantages to lateralization. The main questions of this article are therefore: 1)What are the key factors affecting the choice of posing side and 2) what are different groups trying to convey to the eye of the beholder? And 3) Is posing side in some way related to the fitness success of the model? To address these questions I did some literature research, but because there is very little known about the different groups I also made a database from Dutch politicians which I used to look at the different factors in posing behaviour and fitness. It is interesting to see whether I will find the same biases in this group as previously mentioned by ten Cate (2002) and Nicholls (1999). The website www.parlement.com I used to make the database also included some fitness measures, such as longevity, number of children etc. and it was therefore possible to investigate the relationship between posing factors and fitness measures.

2.1 Posing bias in portraits

In portraits, both photographic and painted, the left halve of the face is overrepresented, with the head turned slightly to the sitters right[24]. It is thought that because the left hemifield shows more emotional expression (emotional expression is lateralized), people tend to show more often their left side of the face

while posing for a photo or painting. There are for example very famous paintings where this is the case, like the Mona Lisa (figure 1). In addition to this left hemifield bias there has also been found that the lighting in a portrait usually comes from the right side of the model[27]. An explanation for this can be that it illuminates the front of the face when the models head is turned to the right. It can also be that the rightward lighting places the left side in relief and accentuates the left sides features. And in addition there has been found that there is a tendency for one eye to be centred in portraiture[28]. It has been implied that centring one eye will balance the arrangement of the painting. Nicholls (1999) found by analysing 137 Renaissance portraits that the eye that is mostly centred is the left eye. The leftward bias in paintings that was found is not present in paintings of scientists from the Royal Society[24] and Dutch universities[1]. This can be explained by saying that it is in the interest of a scientist to look scientific, professional and without emotion, and therefore only show your less emotional right side of the face. There are several causal hypothesis for the leftward bias in portraiture, from which Nicholls (1999) examined the three that are most likely. These hypothesis are (1) mechanical biases by the artist, (2) perceptual asymmetries of viewers and (3) a preference to portray features contained on the left side of the face. I will briefly discuss the outcome of all three analyses.

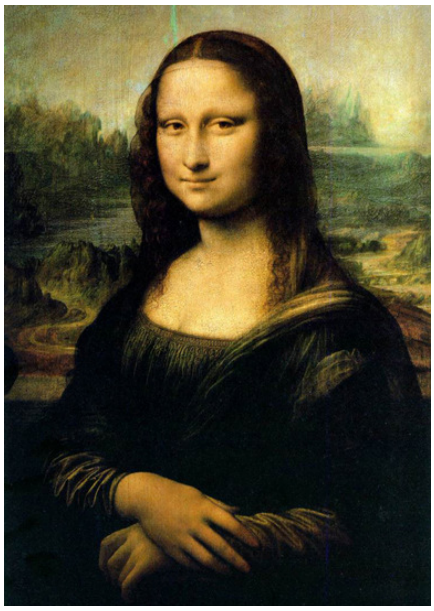


Figure 1: the Mona Lisa painted by Leonardo Da Vinci has a more emotional left cheek pose

The leftward bias can be the result of mechanical bias of the artist, it has been suggested that right-hand artists prefer painting a model on their left, because in that case they do not have to look over their painting arm. The positioning of the model on the artists left can facilitate in positioning the model turning the left cheek to the artist. Another mechanical bias can arise from the arm musculature. The abductive arm movement, which move with the natural swing of the forearm are more quicker and accurate than those that move against natural arc of the arm. It can therefore be more easy to draw a leftward biased painting for a dextral artist, because then the face of the model can be painted more accurate and smooth. This hypothesis was tested by sampling the works of left handed artists, where in theory the paintings should have a rightward bias. In total 101 paintings were collected from to left-handed artists and these paintings were scored on which side is preferred. From the results could be concluded that also in left handed painters the leftward bias was present, so it seems that handedness or mechanical biases play little to no role in the leftward bias of portraits.

The second hypothesis was that of the perceptual preference of viewers and purchasers of the portraits. Asymmetries in the two halves of the face play a great role in the judgement of the painting by others and it is known that viewers are more likely to look to the left side of a painting. Moreover features on the left halve of the face are perceived as more salient and closer than those on the right[24]. The differences in perception of the two halves may be related to the laterality of facial recognition[29]. When a portrait has a leftward bias, more facial features fall in the left halve of the painting, see also the Mona Lisa (figure 1). This differences can account for the differences in facial

recognition, because stimuli falling in the left facial field are projected directly to the facial recognition sites in the brain, which are lateralized in the right hemisphere. Studies that examined chimeric facial stimuli support this hypothesis, they show that humans give more attention to leftward features of the face. Another study found that attractiveness of a portrait was largely determined by the side of the face shown by the model and not by the direction in which the portrait faced[23]. This outcome suggests that asymmetries in perception are dependent on the side of the face that the models shows, more than the way the portrait is arranged. Therefore the second hypothesis can not entirely explain the leftward bias in portraiture.

The third hypothesis is that the leftward bias is generated by the models own choice to show features on the left side of the face. As previously mentioned the left side of the face has a greater expression of emotion than does the right side of the face. This can therefore be the reason that there exists a leftward bias in portraiture. This is also tested by cutting a portrait in halve and joining a left left and a right right halve by mirror reversing them[22]. If the participants where asked which one of the faces showed more happiness or sadness, they tended to pick the left left composite, suggesting that the both left halves expressed more emotion than the right halves joined together. It has also been reported that photographs that show the right side of the face are perceived as being more attractive than photos featuring the right side, even when they are mirror reversed[23]. This is not entirely expected when looking to the other results, but it can be that emotional expression does not serve beauty and that the more reserved right side of the face is therefore seen as more attractive[24]. It may be the case that models intuitively turn one cheek or the other in different posing conditions, like turning the left cheek when posing for an emotive portrait and turn their right cheek when trying to look impassive or powerful. Another explanation can be that painters of photographers can intuitively see which side is more suitable for the situation, and direct the model to show the left cheek when portraying emotion. The third hypothesis can therefore explain the leftward bias, because most of the paintings and photographs are probably made so that they show the emotive qualities of the subject. Nicholls (1999) tested this by letting people pose in different situations by giving them a posing task. The first situation was the pose for a family portrait because the model was going oversees for over a year and wants his family to have a memorial photo on which they could see how much the model loves them. In the second situation the model had to portray a successful scientist that was just accepted to the Royal Society and was asked to pose for a photo in their gallery, in the photo the model has to show as little emotion as possible. Nicholls (1999) found that the in the first situation 58% of the females and 64% of the males showed the left cheek. In the second situation only 43% of both males and females turned left. This shows that people tend to know by instinct which side of their face to show in a particular situation.

2.2 Rightward bias in scientific portraits

As previously mentioned, the leftward bias is not found across all kinds of photographs and paintings. As shown by Nicholls (1999) the leftward bias is not existent in photos of the Royal Society, in fact in photos of that collection a rightward bias is observed. Ten Cate (2002) also showed a rightward bias in the posing orientation of scientists of Dutch universities. He already proposed that there are functional differences between different types of groups in posing behaviour, because different groups want to convey a different message. He also tested if the right-cheeked photographs are perceived as more ‘scientific’. The more

'scientific' look effect should come from which side of the face is showed, irrespective of whether this is mirror reversed or not. The mirror reversal of a portrait makes a right cheeked photograph a left cheek photograph that still shows the original right cheek, therefore it is possible to show whether the side has an effect or that the viewing orientation did. For his analysis he used portraits of professors from multiple European universities. He showed that there is a gradual transition from a right cheek bias to a left cheek bias after 1900 (see figure 2). This suggests that painters and/or models, at least in earlier days, have tried to communicate the rational, 'scientific' look rather than the emotional side of the person. The second thing he showed was that how 'scientific' a portrait was scored had a significant portrait effect, with absence of a mirror reversed effect. He also showed a that the cheek that was showed was highly significant on how 'scientific' a portrait was judged. With right cheek portraits perceived as being more scientific than left cheek portraits, and here also no mirror reversed effect was visible. So it seems that with respect to transmission of a message about the personality of a sitter, viewing condition is not a factor of importance but the cheek that is shown is. This research also supports that posing orientation on portraits can be used to convey specific messages, originating from facial asymmetry in expressing emotions.

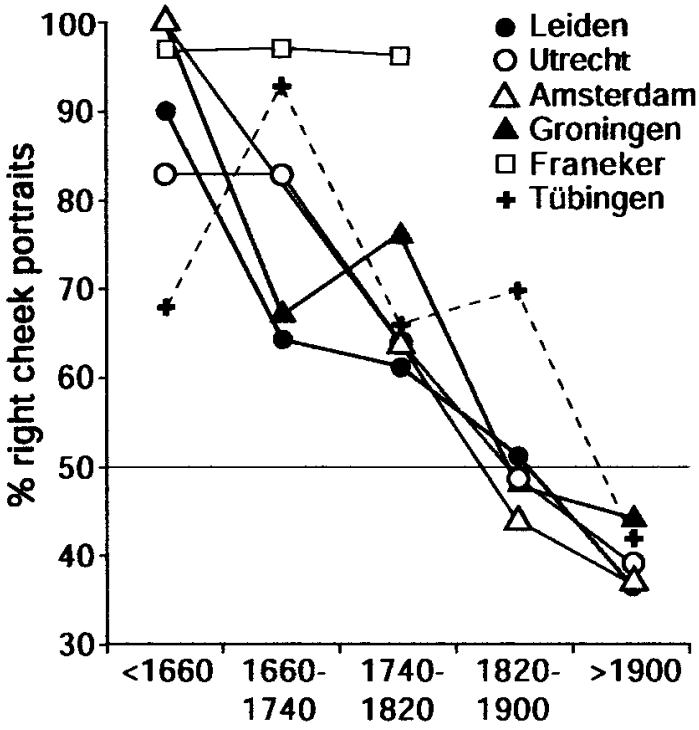


Figure 2: the right cheek bias has a gradual transition to left in university professors (listed by university city)[1]

2.3 Lateralization and fitness

The existence of lateralization shows that there must be advantages at having such a mechanism. As already shown, lateralization of facial expression is used to convey specific messages to the outside world. Because the posing position of a model is used to convey a specific message it is very well possible that the way a model poses is related to how successful he is. As already has been seen in the rightward bias in professors, which obviously have a successful career. But it may also be possible that a posing position not only tells something about how scientific a model is but also something about how reproductively successful he is, but experimental data about this is very scarce. It is very interesting to look at different factors that can account for fitness and career successfulness in a whole other group than the groups that are already looked at. It is therefore that my own data analysis is on a group of Dutch politicians, a group that is never been looked at before in this context.

3 Data analysis; materials and methods

For my analysis of the portraits I used an excel database prepared by a student of the Rijksuniversiteit Groningen (RuG)[30]. This database contained the names of all Dutch politicians active since 1813 with data about their face (right cheek, front or left cheek), their sex, their political view and the timeframe in which they were active (see below for scoring examples). These timeframes were divided in 1) 1982-present 2) 1945-1982 3) 1872-1945 and 4) 1813-1872. With the scoring of which side is shown there is looked at which side of the nose is visible. If the left side is visible it is a left cheek photo and the same with the right side. If both sides of the nose were visible it was scored as a frontal pose. To collect this information an online database was used: www.parlement.com. This database holds a great deal of information about a particular politician, ranging from birth year to how many children he had. Because my interest also goes to the fitness of these people the amount of children seems like a good measure to look at.
For the analysis only those people that were active in timeframe 3 and 4 (N=636) were used, because in those days health care was not as optimal as now and therefore many children did not survive and this is therefore a more 'natural' situation to measure fitness (for as far as humans live in natural conditions). I added the following factors to the database; which eye is higher in the picture (if the head is tilted tot the right the left eye is higher up in the picture than the left), does the person wear glasses because this may determine posture in relation to the light source, from where does the lighting come seen from the model (left/right), year of birth, year of death, active political work years, number of daughters, number of sons, total number of children, how many children died on a young age (seperated for sons and daughters, was the person minister, did he make it past the tweede kamer (house of commons), and did the person receive a PhD. In the broadest context a promoted person is a scientifically scolared person at a university (however many PhD's in the database received their degree from a university faculty of law). The fitness components that were used were how many children one person had, how many children die at an early age, and the sex composition of the offspring. These data was analysed and statistically tested with the use of SPSS 14 and Statistix 8.

Below there are some samples of how photographs were scored.
By the way the jacket is closed (see example 2, 3 and 5) you can see that it is not a mirror reversed photograph, the way the knot closes is typical for jackets that males wear (especially for older photos).

Example 1: Mr. J. Dirks; a frontal pose (both sides of the nose visible) with the light from the right (see the shade on the left cheek) and with the right eye higher.

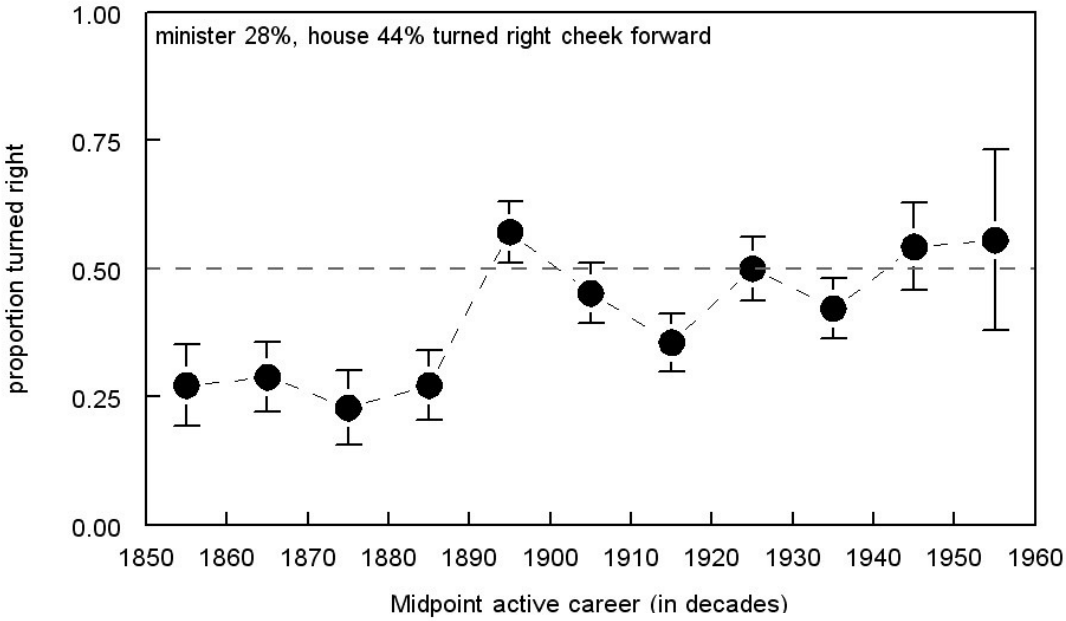
Example 2: A. Buma; A slightly leftward pose (only the left side of the nose is visible), with the light from the left (see the bright left cheek) and with the right eye slightly higher

Example 3: Jhr. Mr. J.W.G. Boreel van Hogelanden; a full leftward pose with the light from the upper left (see the shade on the chin) and no clear eye higher (only 1 eye visible)

Example 4: Mr. dr. J.A. Loeff; a rightward pose (only the right side of the nose is visible), with light from the right (see the shade on the left cheek) and with the left eye higher.

Example 5: Mr. J.G. Gleichman; an almost full leftward pose (only the left side of the nose is visible) with light from the left (see the shade on the right side) and no eye higher.

4 Results



Light source:	left	middle	right
Left cheek	209	30	89
Right cheek	74	19	136

Figure 3: in this figure you see data from every politician with the active career between 1850-1960 from which a clear expression of one facial halve was distinguished in posing behaviour . Data is arranged in decades (1855 = 1850-1860)

4.1 General results

Politicians are not a good representation of the whole Dutch population in the time frame that was analysed. Historically only the well-to-do were able to be in politics, since they were paid no wages. Moreover, the averages in longevity was fairly stable throughout the database and ranged between 70 and 80 years old (average + standard deviation & range), while the average age in the rest of the population was much lower. (see table 2).

Year	1800	1850	1900	1950
Longevity	30	35	44	72

Table 2: Shown is the average longevity in a particular year in the Netherlands (source: www.allesopeenrij.nl)

In the full dataset of politicians with the workmid (middle of their active period) between 1816 and 1994 there is in the majority of cases one pronounced side of the face which the model shows, with a bias towards the left cheek; 64 had no preference, 337 showed the left cheek and 235 showed the right cheek. This leftward bias deviates from 50% (proportion test left vs right: $Z=-4.22$, $p<0.0001$). For the beginning and end of the analysed timeframe (workmid before 1850 and after 1960) there is a very small sample size (N=23) and therefore these data were left out in further analysis. This had very little effect on the preference for one side stated before; 61 had no preference, 326 showed the left cheek and 227 showed the right cheek.

Further analyses on posing orientation (no preference was excluded from the analysis) was performed by *logistic regression* with predictor variables 1) wearing glasses, 2) which side the light came from, 3) birth

year (in decades), 4) was the model promoted, 5) was the model minister, 6) midpoint of his active career. A final model revealed that light (F=49,8, p<0.0001), minister (F=6,54, P=0.01081) and midpoint of the active career (F=4.58, P=0.0328) contributed to explaining the variation in turning bias. There was a positive association between light and cheek, a negative association between minister and cheek (so ministers have a lower percentage right cheek) and a positive association with active period, so proportion rightward poses increases in time (see figure 3). So it seems that the choice for one cheek depends one which side the lighting comes from, if the model is a minister and in what time period he lived.

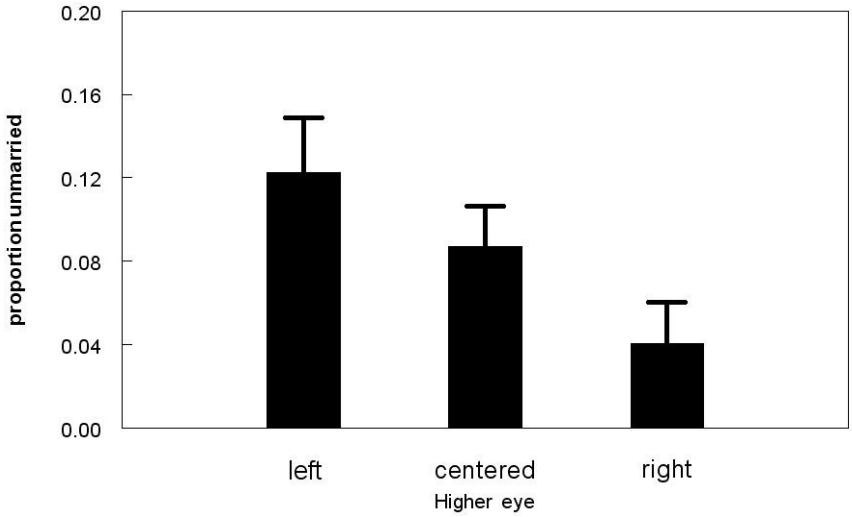


Figure 4: What can be seen is that there is a larger proportion unmarried models in the left eye higher posing.

4.2 Fitness results

In order to analyse the relation between fitness and posing bias the following fitness parameters used in this analysis were a) was the model married b) primary and secondary (after the death of children) sex ratio (expressed as the proportion of sons) c) longevity d) active years and e) number of children and number of children dying at young age. These parameters were tested in a backward *logistic regression* or *Anova* with starting predictor variables 1) minister, 2) PhD, 3) past second chamber, 4) sex, 5) glasses, 6) year of birth, 7) which eye was higher, 8) side of the light source, 9) workmid, and 10) facial orientation. Although 'minister' may in itself be a fitness trait, here it is treated as a predictor variable because it explained some of the variation in posing orientation.

4.3 Parameter one: married or not

For the married/unmarried parameter only the models from the database were used from which was known if they were married or unmarried (N=461). The final model consisted of the predictor variables sex (p=0.0002) and which eye was higher in the portrait (p=0.0270) (figure 4). But the effect of sex could very well be the result of a very small sample size of women. Because from the 10 women in the database half of them was unmarried. In the analysis was found that there is a higher percentage of unmarried models in the portraits where the model turns his/her head in such a way that the left eye is higher (see again figure 4). So turning the left eye higher seems to show a relation to the models fitness and it is therefore likely that posing with the left eye higher shows an explicit message to the outside world.

4.4 Parameter two: sex ratio

For primary and secondary sex ratio only the cases were used that had definite numbers in the amount of children (N= 364 primary SR and N= 374 secondary

SR), there were some cases were the database indicated the a particular politician had more than 1 child without giving the exact number. Cases of this nature were excluded. The primary SR was 0,5008 +/- 0,0154 and the secondary SR was 0,4963 +/- 0,0153. These differed both not from the expected 0,50 (one sample t-test p>0.8). The average chance to die as a son was 0,039 +/- 0,009 and that of a daughter 0,028 +/- 0,008. The slightly higher dying chance of sons did not differ from that of the dying chance of daughters (paired t-test T=-0.99, Df=271, p>0.3). However, none of the predictor variables explained the variance in either the primary or secondary SR.

4.5 Remaining parameters: longevity, active years and number of children

For the other three parameters c) longevity d) active years and e) number of children and children dying at young age three times a one-way *ANOVA* was used *in a backward procedure* with predictor variables facial orientation 1) left middle right, 2) left or right, en 3) frontal or lateral. From these *ANOVA's* was found that facial orientation can not explain the variation in these variables (for all tests p>0.059). Furthermore backward regression over the same variables with predictors that explained variation in posing behaviour before (minister, light, workmid and facial orientation itself) revealed that longevity was positively correlated with workmid (p=0.01) and being a minister (p=0.14) but not with light. Finally, the number of years active was positively correlated with being a minister (p=0.001).

5 Conclusion and discussion

The analysis revealed a very high average longevity throughout the whole database that was used in respect to the average age among the rest of the Dutch population. This can be explained by the fact that Dutch politicians were people that had a high socio economic status and this was reflected in their longevity, because they had the ability to eat well and had access to a medical care when this was needed.

The analysis of the data also showed that the politicians in most cases chose one of the both cheeks to present. It seems therefore that they intuitively know that the both cheeks convey different messages. The leftward bias that was found indicates that the experimental group of politicians also have the emotional and most expressive side bias found in other studies. There was no link found between receiving a PhD and a rightward bias, which was expected because of the results of ten Cate (2002) in university professors. As already mentioned a PhD is only a scientific person in the broadest context of the word. The definition does not account for the profession that the 'scientist' is in at the moment the photo is made, nor is the photo or portrait made to be exhibited in the same context. It can be that only scientists that really want to pose as a scientist and not as a politician have a rightward bias. This is because a scientist has no need to look emotional and a politician does, he might want to convey that he is concerned with the people he stands for, a warm and friendly character that invites you to see his private side.

A positive effect of which side the light came from in explaining the turning bias in the portrayed models was found. This can be explained by the fact that the model in most cases wants to turn the cheek which gets the most light. Therefore a model that has the lighting from his right side turns the right cheek and if the light comes from the left he turns the left cheek. Secondly a lower proportion of ministers exhibited the right cheek. A minister represents a particular part of the government, he must show he is devoted to his job and that people can trust him. One way of showing the people they can trust him is show affection with the people and this can be

achieved by turning the most emotional and personal cheek, which is the left one. So the leftward bias in ministers may be explained by the need to stand close to the people (even more so than members of the house).

In the database there was a positive association between active period and right cheeked portraits, this shows that the rightward poses increase in time. This is not in concordance with ten Cate (2002), who showed that the rightward poses in university professors decreased in time. There is no clear explanation for this, because my initial thoughts were also that the rightward pose would decrease in time. This because I think that in modern days politicians win votes by showing that they are emotionally concerned with the voting people. But it can also be that the opposite is true and that most voting people tend to choose someone who looks rational and looks as if he would never spill their tax money, and therefore the rightward pose is more likely to be shown in more modern pictures. This could easily be tested by showing politicians in two poses and ask people how likely they are to vote for a certain orientation. But because there is very little known about different groups of people and their posing biases it can also be that in general politicians have an increase in their rightward posing behaviour in time.

With respect to fitness, being married or not was associated with the sex of the model and with which eye was higher. The sex association can easily be explained by looking at the composition of the very small sample size of women (N=10). From the 10 women in the database 5 of them were not married. This indicates that perhaps only certain characteristics of women make them successful politicians in this time frame studied or politics changed these women in a different way than men. However, because of the small sample size the influence of sex is one that should be studied more closely by expanding the sample perhaps with portraits of politicians in other countries

The significant association with which eye was higher is more interesting because the sample size for this is much larger. The analysis showed that in the group of models with their left eye higher more were unmarried than in the other two groups of eye levelling. There is nothing known about portraying with one eye higher and what the consequences of this are. But it is imaginable that if a model puts his left eye higher the side of the face you are more likely to look at is the left side. This because the left side is more present in a picture if the pose is with the left eye higher. What is known is that the left side is perceived as less attractive than the right side, this can therefore take account for the ease of finding a life partner. It can therefore be that people who tend to raise their left eye, make their left cheek the more pronounced one and are perceived as less attractive and therefore are less likely to find a husband or wife. But to test this hypothesis more research to this topic has to be done.

For the sex ratio there was no significant interaction found. It can be that there is little to no difference in the costs of raising a son or daughter, due to the fact that all politicians in general have the high socio-economic status. What was found was that the primary sex ratio is slightly higher than the secondary sex ratio, which indicates that sons die more often than daughters. But because this effect was not significant there can be concluded that the dying chance does not differ between sons and daughters.

For the parameters longevity, active years and number of children and children dying at young age no significant association with facial orientation was present. That longevity is not associated may again be due to the high socio- economic status the politicians had. Because they had the

means to life in luxury and comfort, with the access to health care they are expected to life longer. And even in this time the average life expectancy for males in the Netherlands is not above 80, which is slightly higher than the average age in the politicians.

The last thing that came forward from the analysis was that longevity had a positive correlation with workmid and being a minister. The former is very easy to explain by saying that in time the health care in the Netherlands became better, and therefore people lived longer. The former can be explained by the fact that mostly older and experienced people that served for a longer time in the service of the government became minister. It seems therefore that ministers become older, but it can be that the older someone gets the more chance he has to becoming a minister.

So it seems that there are some factors in posing orientation that say, at least in some way, something about the fitness of the model. It can therefore be that we look intuitively to a picture and know it when the model has a low fitness, which can be the case for partner choice and putting your left eye higher on a picture. For further research the suggestion is to use more politicians from different countries to see whether these results are a general image of how posing behaviour is in politicians. Secondly I would suggest to look in more detail to the influence of sex in databases where there are more females in the parliament. It would also be interesting to look at other lateralities in politicians and see whether factors like handedness have an effect on posing bias or not.

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