Facial morphology of brachycephalic breeds: evolution since the end of the XIXth century and current perspectives

I - Bulldog, Dogue de Bordeaux and Pug

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Introduction:

The brachycephalic breeds have been the subject of a very special attention for several years in terms of animal health and welfare.

Some are more affected than others by BOAS (Brachycephalic Obstructive Airway Syndrome), but there is still no data to tell whether the syndrome affects a tiny part of the overall population or a non-negligible fringe.

The French Kennel Club has implemented a functional test (called BREATH stands for BRachycephalic Exercise Aptitude Test for Health) that should answer this question.

Some countries did not wait for the results of the studies to decide and the Dutch government has, for example, under the impulse of lobbies, made impossible the breeding of 12 brachycephalic breeds, by proposing to deeply modify the facial morphology, and thus clearly imposing on the Raad van Beheer to find itself outside the recommendations of the breed standard.

Beyond the unilateral aspect of such a decision which goes against any tradition of selection (whether it be the FCI, the AKC or the KC), which requires that only the Kennel Club of the breed's country of origin, in connection with the breed clubs, can propose a change to the standard, there is certainly no urgency to mess up with the international cynophilia, for a disease, however major it may be, without knowing its prevalence or impact on the breed.

Admittedly, it has been shown that statistically, within a breed, the dogs most affected by BOAS are the most brachycephalic dogs (which have the smallest cranio-facial ratio), but this absolutely does not mean that healthy dogs no longer exist in these breeds!

This short article therefore aims, from archival images, to try to objectify the changes in cephalic profile that may have occurred in the main brachycephalic breeds since the late 19th century.

Over such a long period of time, if significant changes have taken place, they will inevitably emerge clearly. By contrast, to want, in a few generations of dogs, to radically change a morphology that has evolved over decades, is not only to change the appearance of the animal's head, but also the whole body.

The father of comparative anatomy, Georges Cuvier, had already highlighted this with his principle called correlations, in the 19th century. Let’s not forget that zootechnicians like Baron have experimented and rationalized it for domestic species.

The choice to take a sufficiently long period of time (covering the entire 20th century) is deliberate, but we did not want to go back too far in time before the end of the 19th century, because the types were not yet fully fixed and we would not have be able to correctly interpret our results.

No one will be able to offer illustrations of Bulldogs from the 17th or 18th centuries, when the breed had not even fixed its name, and what did they have in common? Buffon never used the term Bulldog, and the illustrations for Dogues are very varied, ranging from barely brachycephalic to much shorter faced animals (Triquet, 2013).

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I - Objectify the degree of brachycephaly of a dog

Raymond Triquet, in his Encyclopedic Dictionary of Canine Terms (Triquet, 1999) defines the term brachycephalic as follows: « Brachycephalic [bRakisefal] adj., N. m. or f.; Brachy prefix "short", cephalic "head". Said of a dog with a short head (and wide or round) like the Bulldog, the Pekingese, the Boston Terrier, etc. »

If we take the anatomical organization of the head of a dog which we proposed in the Centrale Canine Magazine lately (Guintard et al., 2020), we understand that it is above all a reduction of the upper facial region (the muzzle or snout) of the animal that causes this short head (purists will speak of upper retrognathism) and not a reduction in the size of the cranial region.

The best indication in order to objectify this reduction therefore seems to be the so-called cranio-facial ratio, which allows, in a profile view (Figure 1) to relate the length of the face (F) to the cranial region (C).

The lower this ratio is, the more it means that the face is proportionally reduced compared to the cranial region. In order to achieve this cranio-facial index, the measurements of F and C. need to be precisely defined. In a brachycephalic breed where the stop (naso-frontal break) is well defined, it is this natural depression, which will serve as the reference between the skull and the face.

The length of the face will be defined as the length between the stop and the tip of the nose, while the length of the skull will be measured between the stop and the occipital protuberance. In dog shows, the judges who take into account this cranio-facial ratio generally grasp the cranial region in their left hand and objectify with one or two fingers of the right hand the length of the face from the stop.

Recall that a cranio-facial index of 0.5 means that the face represents half the length of the skull, which means, expressed in another way, that the face represents one third of the total length of the head. and the skull two-thirds. Some standards provide these ratios as follows: 1 for the face and 2 for the skull or 1/3 for the total length of the head for the face and 2/3 for the skull.

It should be understood that these different ways of expressing the brachycephalic aspect of the animal are equivalent but give numerical values that vary depending on how the calculation is carried out. Throughout the article, we will mention only the cranio-facial ratio so as not to juggle constantly with values difficult to compare. All breeds considered in this work are clearly brachycephalic, so they all have a cranio-facial index of less than 0.5.

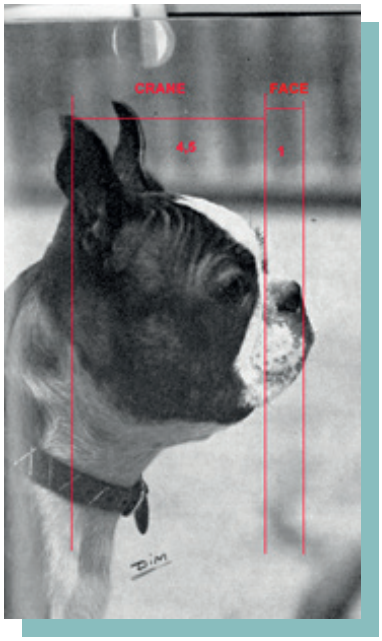

Figure 1: Demonstration of the calculation of the cranio-facial ratio in a Boston Terrier dog seen from the side. This ratio is here 1 / 4.5 (= 0.22).

II - Evolution of the cranio-facial index over time (from the end of the 19th century to the present day)

From pictures of profile dogs, awarded in competitions, the craniofacial index was calculated. For each of the brachycephalic breeds approached, we have tried to take into account a maximum of exploitable pictures, taking care to obtain a picture from the end of the 19th century, one from the beginning of the 20th century (before the First World War), another from the turn of the Second World War, then pics from the 1970s / 80s, then 1990/2000 without forgetting to go to the most recent period (2010/2020).

The cranio-facial index was calculated from photographs of profile dogs, which were awarded in dog shows. For each of the brachycephalic breeds discussed, we tried to take into account the maximum number of exploitable photographs, taking care to obtain a photograph from the late nineteenth century, one from the early twentieth century (before the First World War), another from the turn of the Second World War, then photographs from the 1970s/80s, and then from the 1990s 2000 and also to the most recent period (2010/2020). It seems important to position our individuals in coherent classes of cranio-facial ratios, rather than trying to interpret the absolute values of each photo. Indeed, it is quite difficult to find such photographs (especially for ancient periods), so that the study population is, after all, quite low. In addition, some pictures are blurry or the animal may sometimes not be strictly in profile, so that the precise value of the index does not matter, it is more its order of magnitude and its evolution over time that have been selected. We have not retained the photographs in which the animal was photographed three-quarters, even less from front nor the representations of artists (engravings or paintings) which may be subject to interpretation by the author. On the same animal for which several images were taken from slightly different angles, we observed a variation in the calculated cranio-facial ratio which may not be negligible (of the order of 5 to 20%) which reinforces the idea to keep only the general trend and not to dwell on individual data. Finally, we keep in mind that the cranio-facial index is only one indicator among many others on the type of the animal and that of course, if it is relevant to speak of brachycephaly, it does not explain everything !

The breed we started with is logically the Bulldog. After selecting the most relevant images, a graph was drawn (Figure 2). It appears that several periods appear, with an obvious change in brachycephaly in the years following the Second World War. While in the 19th century and in the first decades of the 20th century the cranio-facial index fluctuates between 1/4 and 1/3, it drops sharply in the 1950s, reaching the extreme values of 1/10 and 1/6. Subsequently, from the 1980s / 90s, this search for hyper-brachycephalic hypertypes seemed to fade to return to indices located between 1/6 and 1/4. We can clearly see that the time required for these morphological changes is between 30 to 40 years, that is to say several generations of breeders. It is therefore unthinkable to go back to this type of morphotypes in a few canine generations, except to do out crossing !

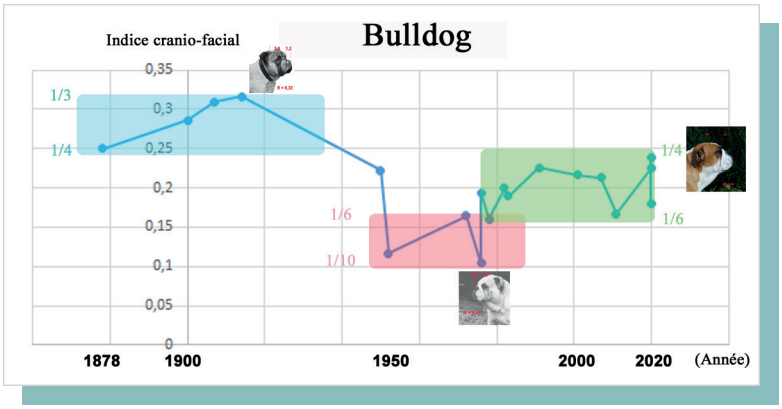

Figure 2: Evolution of the cranio-facial index in the Bulldog breed over 140 years

Depending on the breed considered, the history of selection has not been done in the same way and at the same speed. If we take into account a breed much less brachycephalic than the Bulldog, the Dogue de Bordeaux, while at the end of the 19th century, animals were still selected for their ability to bite during fights, their morphology and type do not seem fully fixed yet. For the same periods (before the First World War), therefore, we find individuals who have a cranio-facial ratio of the order of 1/3 and others who approach 1/2.

In general, it appears that the search for short-faced hypertyped individuals did not affect the entire breed and mainly appeared from the mid-1960s (Figure 3). We therefore find, from this period, and until today, two morphotypes among the champions, individuals who have a cranio-facial index which oscillates between 1/5 and 1/3, with a short muzzle, and individuals with the longer face whose index varies from 1/3 to approximately 1 / 2.2.

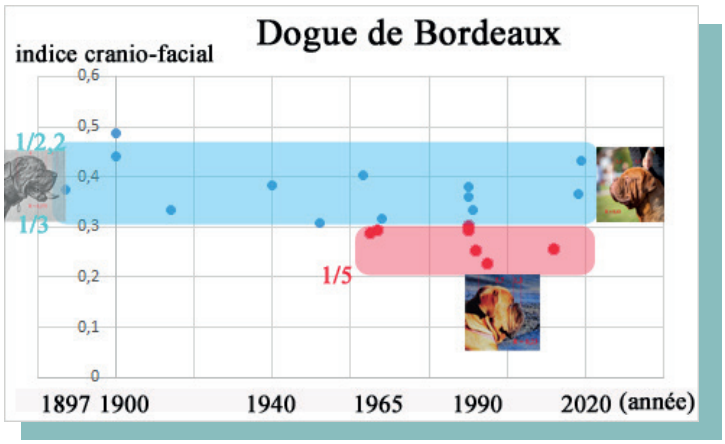

Figure 3: Evolution of the cranio-facial index in the Dogue de Bordeaux breed over 120 years

Unlike the Dogue de Bordeaux for which the appearance of a more brachycephalic morphotype did not make the champions with the elongated face disappear, in the Pug, the breed saw a reduction in the cranio-facial index throughout the 20th century, with an almost total disappearance of champions with an elongated muzzle from the 1980s (Figure 4).

The linear regression line reflects a trend which is statistically significant with a correlation coefficient close to 0.725. We have gone from a craniofacial index between 1/6 and 1/4 since the end of the 19th century. and until after the Second World War at an index falling between less than 1/10 and 1/6 and with hypertyped animals since the 2000s.

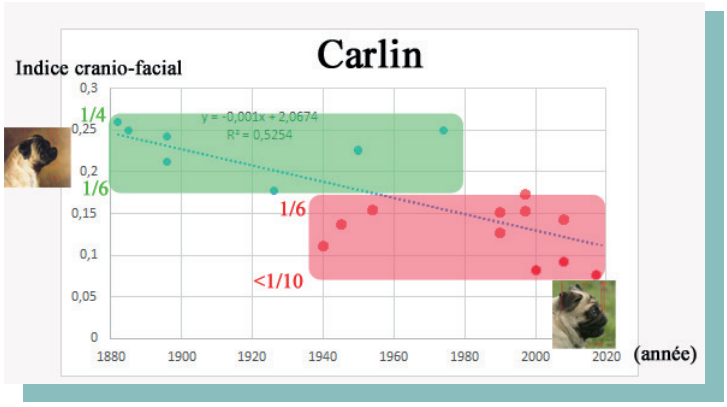

Figure 4: Evolution of the cranio-facial index in the Pug breed over 120 years

Here we can see the strong idea behind this study, depending on the breed considered, the cranio-facial index that can serve as a standard to correct a drift that goes towards the hypertype, varies according to the breed. It is absurd, if not utterly stupid, to propose an identical threshold for all brachycephalic breeds. Ignorant people sometimes suggest that they come up with a single index of 0.5 (that is, the face is one-third of the total length of the head); we see that with the pug, even in the 19th century, we did not achieve these values! (at the end of the 18th century, we have representations of animals, ancestors of our current pugs, whose index is only 0.43 [in Brown, 1997]). This implies that decades, if not centuries, of selection within a breed would be abandoned (and wiped out). In other words, we no longer want this breed on Earth, at this price. But let's remember that the Dog is the first species domesticated by humans for more than 20,000 years.

Conclusion

Even if for the moment, the main brachycephalic breeds have not been approached (they will be addressed with the second part of this work), we perceive between the current hyperbrachycephalic Pug (craniofacial index <0.1) and the Dogue de Bordeaux from the beginning of the 20th century. (craniofacial index> 0.45) enormous morphological diversity. All the breeds do not start from the same point and a Pug from the beginning of the 20th century. is already a breed very oriented towards brachycephaly (craniofacial index between 1/6 and 1/4) which means that the current efforts that we perceive to «lengthen the noses», must be done while respecting two fundamental things and in a reasoned way:

The craniofacial ratio towards which a current breed must strive to get out of the hypertype zone is a function of the breed and cannot be decreed unilaterally for all breeds. You have to respect the breed type and go towards a type that has existed in the breed. To ask to have pugs with a craniofacial ratio of 0.5 (that is to say a muzzle which represents 1/3 of the length of the head) is to go towards a «monster» which has never existed in the breed ! (except considering ancestors from several centuries ago that no dog lover today would dare call a pug).

This work must be done with the consent of breeders and breed clubs so that people do not turn away, either from the starting breed (we see this in Switzerland with the Conti and the Bulldog), or from animals of pure breed (by continuing to breed the type sought, but outside pedigree), and this work must be done over a sufficiently long time. The changes highlighted in this work correspond to a period of around 2 or 3 decades, or even more. One cannot imagine solving problems with the wave of a magic wand, even though the dog is one of the very malleable species which can be selected and shaped quite quickly.

Finally, we must keep the problem in mind. The current problem is BOAS, a respiratory syndrome, certainly correlated with the brachycephalic hypertype, but by no means the problem of the brachycephalic breeds, which are very popular and widely bred! So targeting those races and banning them would be solving a problem by eliminating the problem breeds and not the problem. Of course, if the breed disappears, it swallows up its problem with it, but all healthy animals are also eliminated, which are the vast majority in all current breeds and which do not want better than to live. Let's encourage the breeding of healthy animals in brachycephalic breeds, select them with the right tools, it will be smarter than eliminating them en bloc!

Special thanks :

The authors would like to warmly thank all the actors who were involved in the realization of this work and without whom nothing would have been possible! The search for usable photos (in profile) has sometimes been a challenge, it is not necessarily from this angle that we spontaneously photograph a champion ... All those who at one time or another of this work have there provided their assistance in it are therefore thanked, and those whom we would have forgotten in the list «à la Prévert» which follows please forgive us, their contribution was as important as that of the others.

We will not detail the contribution of each or each, but we would like to thank in alphabetical order:

Daniel Béguin, Yvette Betemps, Céline Bottussi, Marie Briand, Frédérique Chancel Aguirre, Viviane Couleard, Elodie Duez, Lydie Estru, Dorothée Fabre, Caroline Gurtner, Patrice Jauffret, Christian Karcher, Annick Laurent, Sophie Licari, Hélène Marcinkowski, Sylvie Mignon, Florence Monnier, Virginie Oeillard, Rui Oliveira, Karine Sanson, Sylviane Tompousky, Raymond Triquet, André Varlet, Elyse Waget and all the breeders who sent us photos.

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