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SOGen



YOUR FUTURE FOAL IN 3D

Bernard DUMONT ST PRIEST
Pôle DIR (développement, innovation, recherche) de l'IFCE


7th IWSLP
29 - 30 March 2023
Grebin / Plön, Germany




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Summary

- 1. The SOGEN project and morphometrics**
- 2. Morphological profiles and the notion of Global Format**
- 3. Perspectives on morphological characterization and indexing : use of artificial intelligence and image recognition**

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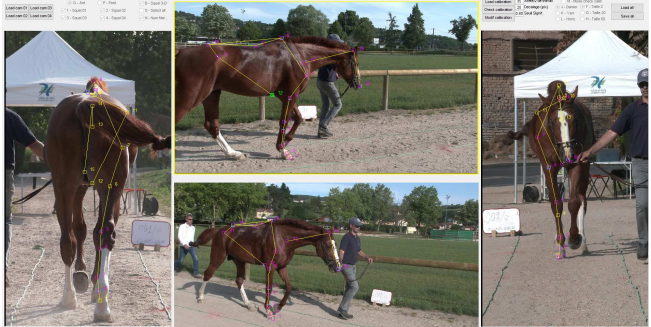
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1. SoGen results usable as cross-referencing tools

Each horse filmed walking by 4 synchronous video cameras




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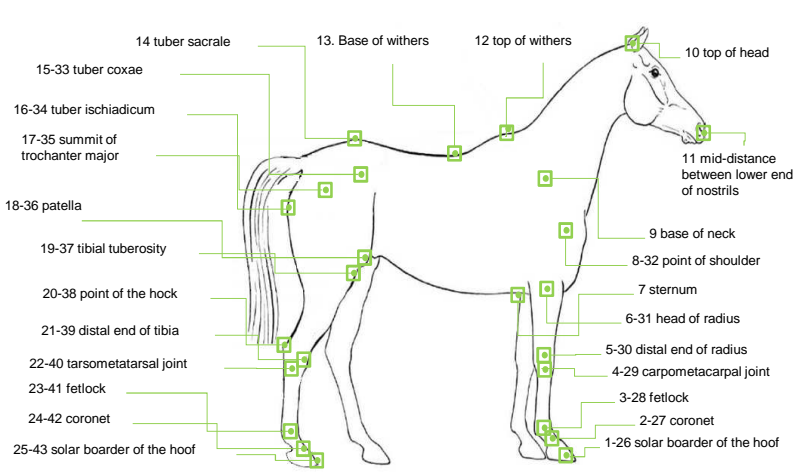


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28 markers placed on characteristic locations :




- 14 tuber sacrale
- 15-33 tuber coxae
- 16-34 tuber ischiadicum
- 17-35 summit of trochanter major
- 18-36 patella
- 19-37 tibial tuberosity
- 20-38 point of the hock
- 21-39 distal end of tibia
- 22-40 tarsometatarsal joint
- 23-41 fetlock
- 24-42 coronet
- 25-43 solar boarder of the hoof
- 13. Base of withers
- 12 top of withers
- 10 top of head
- 11 mid-distance between lower end of nostrils
- 9 base of neck
- 8-32 point of shoulder
- 7 sternum
- 6-31 head of radius
- 5-30 distal end of radius
- 4-29 carpometacarpal joint
- 3-28 fetlock
- 2-27 coronet
- 1-26 solar boarder of the hoof

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SoGen results usable as cross-referencing tools :

The morphological analysis made on 2000 horses makes it possible to propose a 3D morphotype prediction tool for foals produced by a stallion

Since 2019, we presented the results of the SoGen project on 3D morphometry. These scientific results made it possible to determine the main axes of genetic morphological differences between horse's families


From a sample of 2092 horses and a procruste analysis of the 3-dimensional coordinates of the 43 anatomical landmarks identified on the horse, we extracted the genetically transmissible morphotypes.

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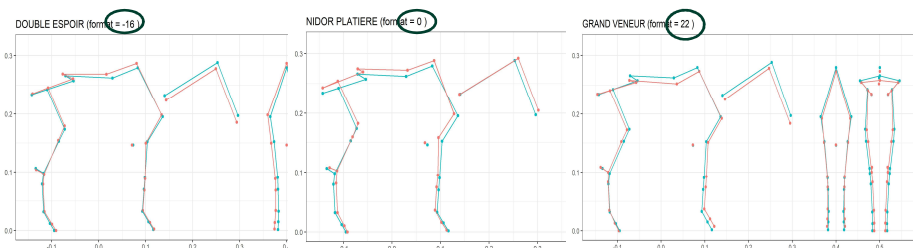
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2. The "Format" and the "Profile"

For the progeny of each stallion we must first put all the dimensions into perspective by calculating its "format index" which integrates its heights, lengths and widths.



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« Format » ... then « Profile »

*Landmark :
Withers appears on each of the 3 views*

Once this format correction has been carried out, we move on to the analysis of the profiles from the three angles;

the progeny of the stallion (in red) is compared to the average of the reference population (in blue) :

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The set of qualifiers to objectively describe the progeny of each stallion:

Apache was producing noticeably smaller than average;

its progeny is built "uphill" (high withers and low hips);

their joints are low; they have a great depth of chest.

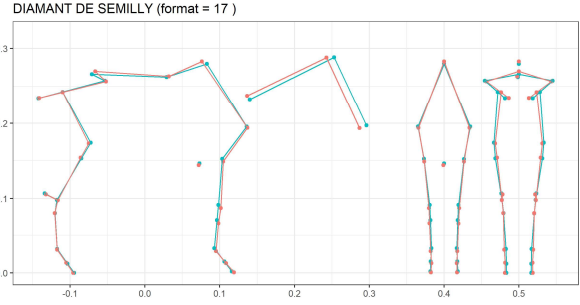
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The set of qualifiers to objectively describe the progeny of each stallion:

Diamant's progeny is estimated to be higher than average (Format +17); After correcting the format, his offspring have a very standard profile.

The neckline is, however, relatively short ; if we refer to the base of the withers, the sacrum and the top of the withers are quite prominent.



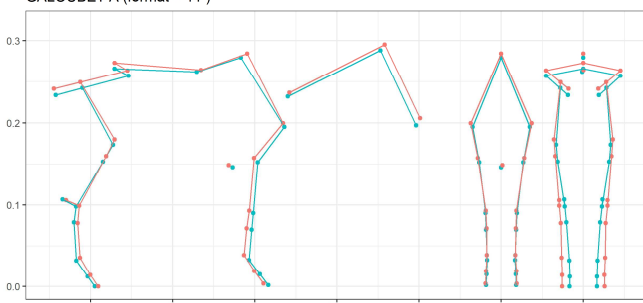
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The set of qualifiers to objectively describe the progeny of each stallion:

Galoubet bequeathed a long neckline and wide rear tracks.

Its progeny is generally "higher than long". The shoulder is more vertical than the average.



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The set of qualifiers to objectively describe the progeny of each stallion:

The main characteristic of the descendants of Narcos resides in their sacrum and their particularly high hips, hence their plunging profile despite a very tense backline.

NARCOS II (format = 3)

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... or the seven families game:

Uriel's production like that of each of his stallion sons is characterized by tight posterior tracks

URIEL (format = 3)

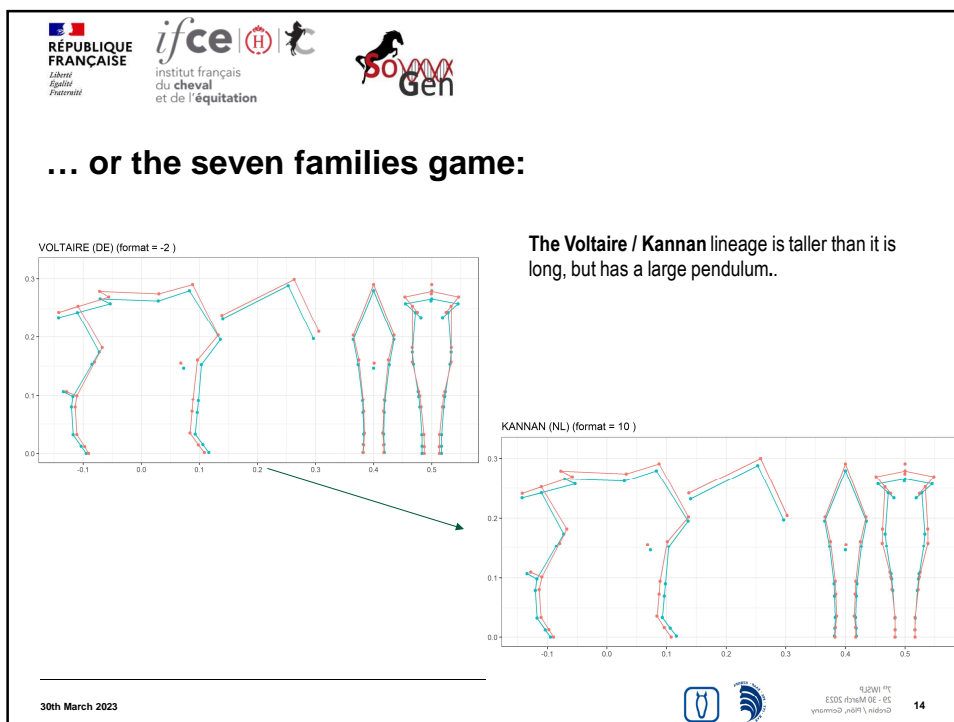
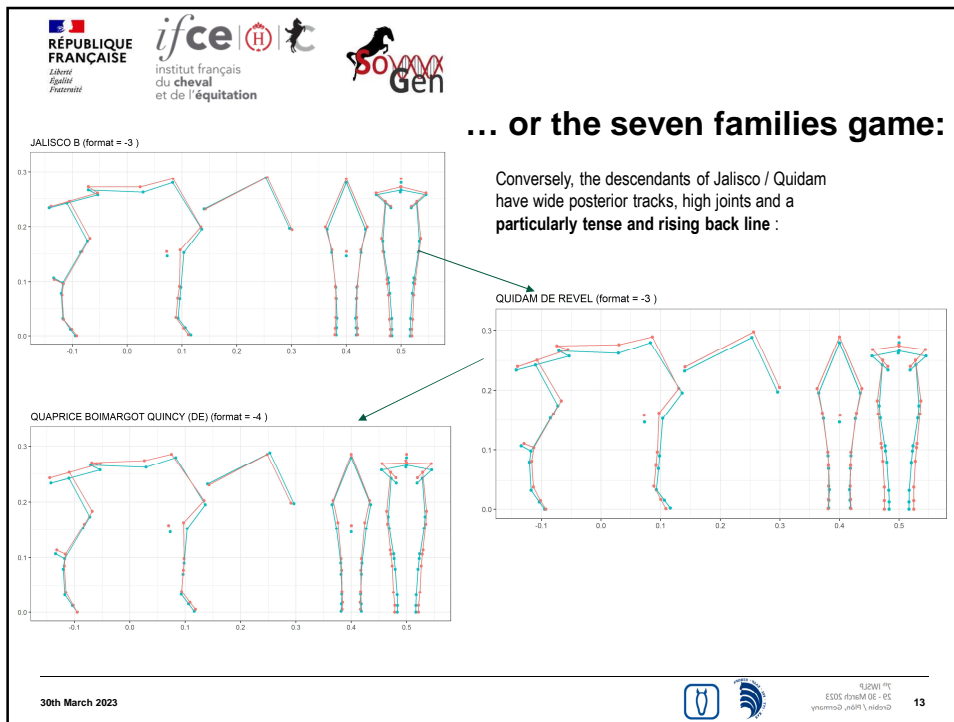
ROSIRE (format = 2)

ARPEGE PIERREVILLE (format = 4)

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... or the 7 families game ... with some surprises !

DIAMANT DE SEMILLY (format = 17)

APACHE D'ADRIERS (format = -13)

X

The Rock'n Roll Semilly's progeny looks more as the progeny of his grandfather (Apache d'Adriers) than the progeny of his own father (Diamant de Semilly).

ROCK'N ROLL SEMILLY (format = 1)

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Some questions that will be the subject of future publications:

- What is the level of heritabilities?

- What CDs? From how many foals measured can significant determination coefficient be obtained for a stallion?

- Major genes?

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Perspectives ?

We are now able to offer the 3D image of the morphotype corresponding to the production of each parent standard of products from the initial protocol.

By generalizing the method, we could do the same for any stallion. Beyond a fragmented description offered by any score, we have here an objective genetic tool that takes into account the morphology as a whole.

The limit is currently the human time to locate the morphological landmarks on the image; the next development will soon go through artificial intelligence and image recognition.



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Thanks to :

Anne RICARD who carried out all the calculations for this modeling and who writes each scientific publications on the subject,

to Nathalie CREVIER DENOIX et Philippe POURCELOT qui avaient mis au point la méthode M3D,

to the team of phenotyping people from IFCE who contributed to the field surveys and image processing,

and to Société Hippique Française & Stud-Book Selle-Français who, through their breeders, riders and owners have made their horses available for this project,

... and to the funders of this great project:



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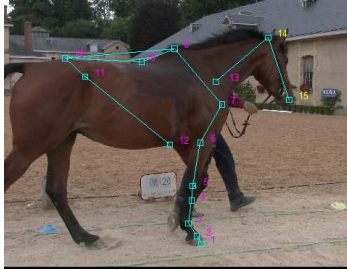
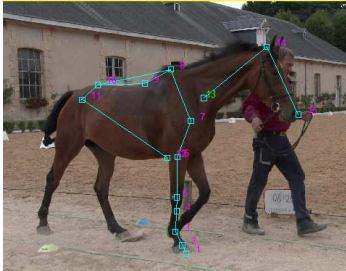
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Here are some additional slides to answer any questions you may have :

Morpho 3D to avoid parallax errors :

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Here are some additional slides to answer any questions you may have. :

Morpho 3D to accurately measure angles of deviation (plumbs)






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