BELGIAN BLUE WHETSTONE

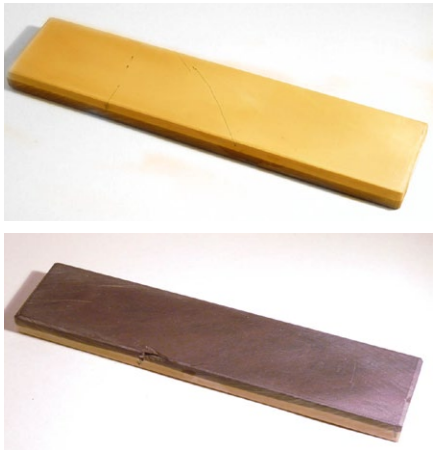
A study of its aptness for sharpening straight razors

Belgian Blue Whetstone (BBW) is closely related to Belgian Coticule, a well known sharpening stone with a long-standing reputation for sharpening razors. Coticule stone occurs naturally in narrow yellow veins surrounded by a blue schist. Where this blue schist borders on the Coticule veins, it contains similar spessartine garnets as the Coticule rock, albeit in a lesser concentration and in a somewhat larger granulometry (Ulrich Kramm, in "The Coticule Rocks (Spessartine Quartzites) of the Venn-Stavelot Massif, Ardennes, a Volcanoclastic Metasediment"[1])

Preface

Because of their geologically engrossing background, both types of rock have been subjected to extensive scientific study. However, these studies focused primarily on their geological and mineralogical properties, tangentially touching on their abrasive properties as sharpening stones. With this study the authors collected empirical data about the ability of BBW to produce a straight razor edge that meets their subjective requirements for comfortable shaves. Protocols were developed for both sharpening the test razors and for submitting the results of a series of test shaves by different individuals to arrive at a data set that allows comparison of different sample whetstones. Two BBWs and one Coticule were selected, and the three resulting razor edges were compared side by side by a panel of 8 individuals.

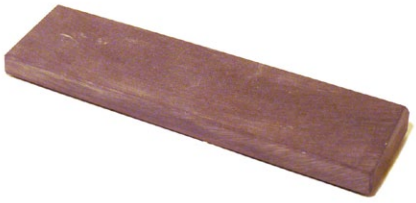
Selection of the sample whetstones



La Veinette sample, yellow Coticule and blue BBW side.

For the Coticule, a stone was selected from the La Veinette layer. This is a very narrow strata that is extracted naturally bonded to a BBW counterpart. Due to its narrowness, La Veinette is renowned for consistent abrasive properties. It combines a fast speed when used with its own abrasive slurry with highly refined finishing properties when used with only water. From ancient times to present day, La Veinette vein has received the highest quality classification. Both the consistency and the outstanding reputation of La Veinette vein were considered when selecting a Coticule as the benchmark to which two BBW stones were to be compared.

1 *available in PDF-format at: http://www.springerlink.com/content/v30225w52k280jg1/fulltext.pdf*



BBW-sample

As mentioned, La Veinette is naturally bonded to a BBW counterpart, so the first BBW candidate was easily chosen. This hone will be referred to as "CotBBW". For the second BBW candidate, a separate BBW was randomly selected. Both hones were kindly provided by Ardennes Coticule, the last operational mining company of the studied hones.

The Straight Razors

Three identical Double Arrow straight razors were used to run all sharpening tests. Double Arrows are mass produced Chinese razors known to be cheap, but with steel that supports a good shaving edge. The test razors were modified to have a straight edge instead of their typically curved ("smiling") factory edge. The shoulders of the blades where slightly ground back to allow more clearance for the heel of the blade while sharpening. Both adaptations were made to facilitate sharpening and reduce the risk of human error sneaking into the results.

The razors were labeled A, B, and C. During the tests, they were rotated, meaning that each razor was re-sharpened with a different sample hone for each test person. This served to average out any deviations attributable to the razors.

The Test Panel

Eight individuals of varying age and experience with straight razors participated in testing the edges. With the exception of one participant, who only test shaved with the razors, each participant dulled the razors after completing his test shaves and re-sharpened them for the next person in line. This approach was chosen to incorporate repeatability of results and test ease-of-use of the BBW sharpening protocol into the research. Since it is customary in the world of straight razor users to sharpen one's own razors, it was considered important to investigate if the obtained results could be met by individuals of varying expertise.

All participants test shaved the razors without knowing which razor was sharpened with which sample hone. After submitting their completed test reports, they received an e-mail with the new honing order. They were expected to dull all razors by rubbing them edge-down on a glass object and confirm that it no longer could shave arm hair before re-sharpening them by following a strict procedure.

The Test Shaving Procedure

For testing the razors, the participants performed full shaves using 2 razors at once: one for each half of their beard area. They were asked to follow their normal shaving routine, and normal interval in between shaves, making sure to stray off their set routine as little as possible.

They performed 3 test shaves:

1. razor A on left side of face / razor B on right side of face
2. razor B on left side of face / razor C on right side of face
3. razor C on left side of face / razor A on right side of face

This protocol resulted in each razor being evaluated twice, once for each facial half. Additionally, it resulted in a direct side-by-side comparison of each razor against all others. After each test shave, the participant submitted a standardized Razor Performance Form (RPF) . The scores entered on this form were entered in a data set for statistical processing.

The Razor Performance Form (RPF)

Data was collected for 4 parameters:

1. HANGING HAIR TEST (HHT)[2]

This is a test that probes the raw sharpness of the edge. A supply of hairs for this purpose was passed on with the razors, to assure that all HHT were conducted with the same hair. Five scores were defined:

0 fails
1 Hair "plays violin": faint ringing sound can be heard while the hair is pulled over the edge.
2 Hair needs to be pulled across edge to split lengthwise
3 Hair needs to be pulled across edge to pop
4 Hair breaks as soon as it touches the edge and pops away
5 Hair falls silently as soon as it touches the edge.

2. SHAVE-ABILITY

Mainly assessed during the "against the grain" pass of the shave.

0 Razor shaves not or only marginally
1 Razor shaves, but pulls and skips hairs
2 Razor shaves with pull and hangs up on stubborn whiskers
4 Razor shaves well with obvious pull
6 Razor shaves well with mild pull

2 *full elaboration available at http://www.coticule.be/hanging-hair-test.html*

8 Razor shaves very well with a faint resistance
10 Razor shaves completely effortlessly

3. SHAVING RESULTS

0 Shave aborted due to lack of result
2 Stubbly result
5 Stubbly with some smooth patches
8 Smooth with some stubbly patches
10 Completely smooth

4. SKIN CONDITION

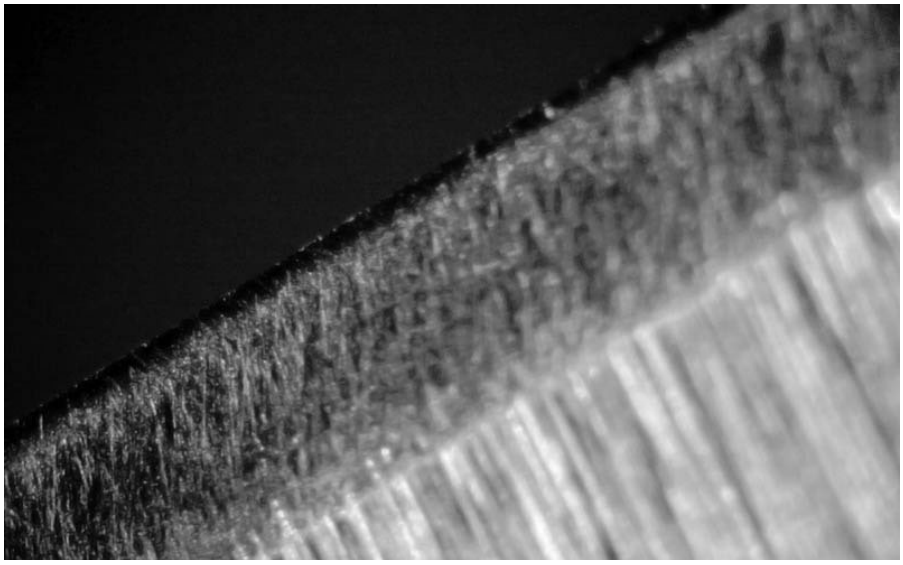
0 Heavy skin irritation with redness
2 Mild skin irritation without redness
8 Skin feels rejuvenated
10 No effect on skin whatsoever

In addition to these fixed scores on the RPF, the participants were free to share comments about all edges. Where applicable, these comments were incorporated into a corrected data set, published in this study. For example, when a participant gave both razor A and B a score of 8 for skin condition, but he commented that the slight facial peeling effect lasted longer on the A-side of his neck than on the B-side, the score for A was corrected from 8 to 6 on the final data set.

The sharpening procedure

The procedure used to sharpen with the Coticule is known as Unicot. This method first establishes a good bevel on the razor by using the Coticule in its fastest mode with a slurry atop the stone. During a second stage, a layer of 0.15mm thick electrical tape is add to the spine of the razor, in order to create a secondary bevel at slightly raised angle (approximately one degree). Such a narrow bevel easily gains additional sharpness, even on the hone used in its slow, water only, mode. The resulting secondary bevel provides the maxed-out keenness of the hone, and has exclusively inherited the used hone's edge characteristics, for this secondary bevel is entirely formed by that hone only. By dulling the previous edge, subsequently reestablishing the main bevel, and finally cutting an entirely new secondary bevel, any possibility that the previous sharpening job "shines through" the new one, is completely eliminated.

For the sharpening with the BBW sample hones, a very similar procedure was chosen, with the one alteration that the edges



Edge of one of the BBW-honed sample razors, at 60X magnification, illuminated by a shearing light source. For each new sharpening, the edge was dulled, the primary bevel restored and a new secondary bevel formed, all with the same sample hone.

were not finished with pure water on top of the BBW. Instead, a misty hint of slurry was used. During the preparatory research for this study, it was discovered that this hint of slurry yielded better results on the BBW with this particular procedure than the use of pure water. It is speculated that, with water only, the BBW is too slow to undo the slight bevel tip deterioration that any passage over the microscopically uneven surface of a hone will cause. The ability to make up for that deterioration and add refinement to a point where it can do no more is the difference between a "whet"stone and a just a stone. It seems that the BBW, when used with water only, on hardened razor steel, flirts with that distinction.

This is the exact instruction set that was given for using both BBW sample hones:

1. Perform halfstrokes on slurry with milk-like consistency until the edge shaves arm hair. This will take longer than on the Coticule.

2. Perfect the bevel with 50 laps on halfway thinned slurry.

3. Apply one layer of tape.

4. Perform 20 X-strokes on halfway thinned slurry. Rinse razor and BBW.

5. Rub the BBW back and forth ONCE with the slurry stone (apply gentle pressure).

6. Finish the razor with 50 X-strokes in stropping direction (i.e., edge trailing).

While it can be considered an advantage for edge finishing when a hone sneaks up very slowly to its maximized keenness limit, it remains important that it offers enough abrasion to undo its own – however slight – deteriorating effect on the tip of the edge. Otherwise, one ends up with beautifully polished bevel sides that meet at a disappointing edge radius. To avoid all possible problems in this regard, it was decided to finish on the BBW with the thinnest possible slurry, as this clearly improves the abrasive properties of the hone without introducing the disadvantages of a dense slurry.

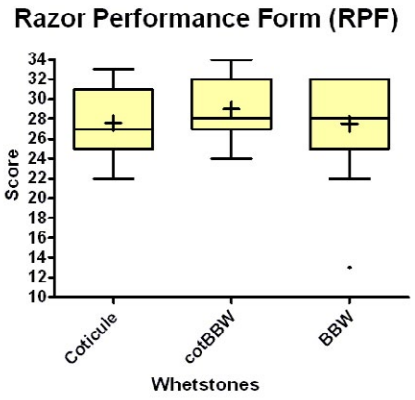
To further avoid any possible influence of the bevel tip collision with the garnets in the slurry, the finishing strokes were performed in an edge trailing direction. More research is required to investigate the exact influence of various slurry densities on the BBW and the difference between edge leading/edge trailing passes during the final stages of sharpening.

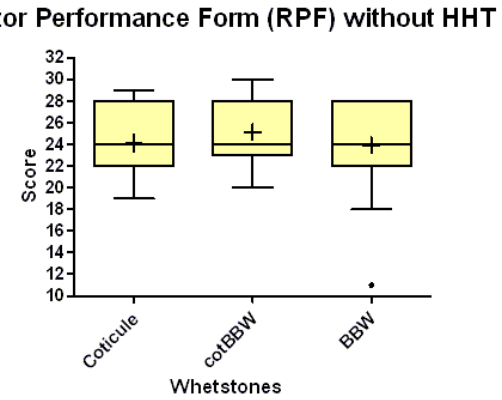
After sharpening, all edges were stropped on a fabric strop followed by a leather strop. Each participant used his personal strop for this task, and no abrasive pastes were allowed. The directive was given to perform 60 laps on both components immediately after finishing on the hone. All participants were advised to briefly test the edges during a shave test, to rule out a possible human error in honing. Starting over was allowed if such a human error was suspected.

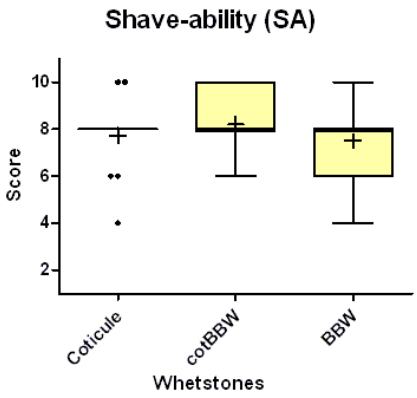
What the box plots show:
(Box plots defined after John W. Tukey).
The yellow boxes comprise the values between the upper and lower quantiles. The bottom and top of the box are always respectively the 25th and 75th percentile. The line near the middle of the box is always the 50th percentile (the median). When the median has the same value as one of the quantiles, it has been made bold. The whiskers represent the lowest and highest value still within 1.5 IQR (interquartile range) of respectively the bottom and the top of the box. The dots are individual outliers. The cross is the average value.

All diagrams and statistical calculations were contributed by Robert Proß.

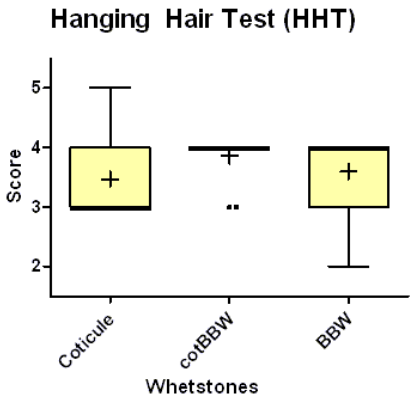
The statistical significance of the data set was checked with the Friedman ANOVA[3] test.
In the data set and the diagrams, "BBW" refers to the separate Blue Whetstone and "CotBBW" refers to the BBW-backing of the La Veinette stone. "Coticule" obviously refers to the yellow side of the La Veinette stone.
If the data set (see table in the addendum) reveals anything, it is that the edges on the test razors showed great similarity regardless of which sample hone was used. It is possible that the steel of the chosen test razors was a limiting factor for the obtained results. Even so, all reported highly acceptable shaving results that seemed on par with their expectations for a good shave. The HHT-scores demonstrate that none of the hones had trouble putting a similar level of keenness on the razors.







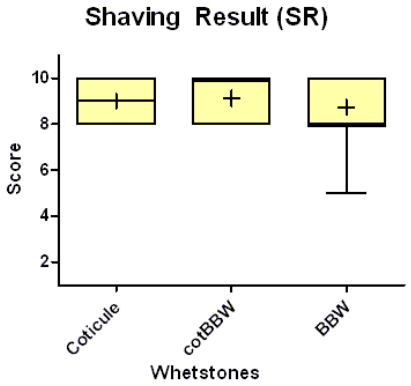
As the diagrams show, the overall scores of the edges produced by these 3 hones are quite similar. Since the HHT offers only an indirect marker of the shaving properties, there is also a diagram presented with overall scores omitting the HHT results. In this diagram, the median for all three hones is the same, which illustrates how close the results were.
Upon consideration of the important parameter of shave-ability (SA) we see equally close results. If differences must be stated, it can be said that the Coticule was the most consistent in outcome, the median of the BBW had a downwards penchant and the median of CotBBW shows an upwards penchant.



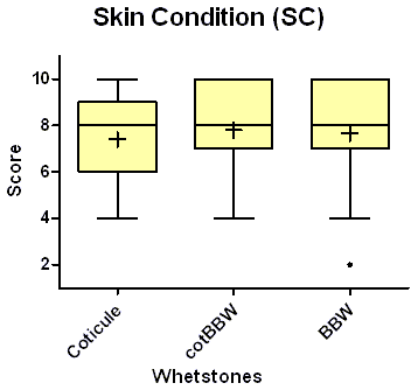
If we look at the medians of the HHT diagram, the CotBBW scored most consistently 4, the Coticule received a median score of 3 with a penchant towards 4, and the BBW a 4 with penchant towards 3. In more prosaic terms: the Coticule grades: 3+, the BBW: 4– and the CotBBW: 4. This reveals a correlation between

3 *ANalysis Of VAriability, a mathematical test for determining the significance of statistical data. Friedman ANOVA is also called two-way ANOVA for ranks, which is a nonparametric test that compares series of paired groups.*

the HHT and the shave-ability, whereas the hone that ranks highest on the HHT test also ranked highest at the shave-ability results, the hone with the HHT-score of "4–" came second in the SA, and finally the hone with the HHT-score of "3+" came third. Notwithstanding these are extremely small differences within the spread of ranges that share the same median, this correlation affirms what could be logically expected from the relation between shave-ability and the HHT. Examining the individual test shaves in the data set, we can observe the same correlation.



The diagram of the shave results (SR) confirms the performance of the 3 edges: All hones performs within a range between scores 8 and 10, but if we translate the boxplot to our more prosaic grades, we see that the CotBBW again arrived on top: 10–. The Coticule: 9 and the BBW: 8+ traded places. This illustrates how close these results actually are, they are as close as the readings allow without being identical. The fact that the BBW and the Coticule reversed ranks on the SR and SA scores is another illustration of their close match.



Skin condition shows that all three hones delivered edges that centered around a rejuvenating impact on the skin of the test persons, with almost identical results for both BBWs and the same median for the Coticule, but with slightly differing quantiles. This rejuvenating effect can be attributed to a slight beneficial skin peeling. It is an effect well known to all wet-shaving men.

Overall, it must be concluded that with the sampled hones and within the limitations of the chosen research method and the steel of the razors, the perceived differences were extremely small.

Conclusion

We have attempted to study the capabilities of Belgian Blue Whetstone to put a satisfactory shaving edge on a straight razor by letting two random exemplars compete against a Belgian Coticule of premium reputation. The results show that a random group of straight razor users found BBWs capable of successfully sharpening razors with the suggested procedure.

A series of blinded tests demonstrated that these edges performed on par with the Coticule edge. While BBWs likely lack the abrasive speed to reach as far into dullness as a Coticule can, once a razor has a decent bevel, a BBW can be considered a valuable alternative for refining and finishing the edge of a straight razor.

Critical discussion

While analyzing the data set it became apparent that not all researchers connected the same purport to the collected test results. The concept "sample" needs to be critically approached at multiple levels of this experiment. Therefore, the weaknesses at the various sample levels are discussed below:

1. Sampled razors

Three representatives of the same razor brand and model were used, ordered together in a purchase of 40, and for that reason, likely of the same production batch. Averages were calculated for each razor per used hone, and checked to see if the deviations fell within the standard deviations for each hone separately. As this was the case, it can be concluded that the razors were sufficiently equal to dismiss razor variability as a possible cause of error. It must be acknowledged that of all existing straight razors, only Double Arrows were sampled. To what extent this choice limits the claim that BBW's are capable of producing an acceptable edge on razors of all makes and models, is food for further investigation. It must be noted that Double Arrows are not considered the easiest razors to sharpen, and neither are they renowned for the smoothness of their shaves. As such, they may have been a limiting factor in this experiment.

2. Sampled hones

Two BBWs were used. The selection was de facto random. Whether these 2 represent the majority of BBWs remains to be seen. In the preceding research, 5 other BBWs were used in search of a consistent procedure. The possibility of both hones, used for collecting the data, being flukes, can be ruled out unless these 5 other BBWs were flukes as well.

The choice to use a La Veinette Coticule for reference hone can be challenged. However, the scope was not to determine the BBW's edge finishing qualities in comparison with a wide range of other suitable razor hones, but to investigate if the BBW is a valuable alternative for producing an acceptable edge on a razor, with aid of one single stone, as this is often done with a Coticule. The goal was to find out if the BBW edge surpassed the requirements for a comfortable shave, without making preferential statements about it.

3. Sample group of test persons

Eight men contributed test results to the data set. This can't possibly be a large enough test group to be representative for the

entire male population. If we were to look at the average scores and use them to rank the hones, it is possible that 8 other men would come to a different ranking, should they repeat the entire exercise. Ordering hones in a kind of hit parade is as frivolous as pop music charts, for both largely depend on personal preferences and even on what's fashionable at a given time. This was obviously not the goal of this experiment.

To determine if the edge produced by a BBW can meet the requirements for shaving, one man's observations would have sufficed, but in order to investigate if it could be successfully done by persons of various experience, and to exclude the possibility of bias, the choice was made to run the experiment with multiple participants conducting blinded test shaves.

In that respect, the data set serves to reveal whether a BBW can meet the requirements for producing a functional edge on a razor, and not to determine a true ranking of the three utilized hones.

Research team: Caleb Duncan, Ray Habyan, Gary Haywood, Ralfy Horsepool, Robin Kroha,Torben Pedersen, Robert Proß, Jim Richmond, Paul Richmond, Matt Tajsich, Bart Torfs.

next page: addendum with table of test results.

HHT	SHAVE-ABILITY	SHAVE RESULT	SKIN CONDITION	TEST PERSON	RAZOR	HONE	**SCORE**
4	8	10	10	a	B	BBW	**32**
4	8	10	10	a	B	BBW	**32**
4	8	10	8	b	C	BBW	**30**
4	8	8	8	b	C	BBW	**28**
4	8	10	10	c	A	BBW	**32**
4	8	8	8	c	A	BBW	**28**
4	10	8	10	d	A	BBW	**32**
4	6	8	4	e	B	BBW	**22**
4	6	10	4	e	B	BBW	**24**
2	4	5	2	f	B	BBW	**13**
3	6	8	8	f	B	BBW	**25**
3	8	8	7	g	C	BBW	**26**
4	8	8	8	g	C	BBW	**28**
3	9	10	9	h	B	BBW	**31**
3	8	10	9	h	B	BBW	**30**
3,60	7,53	8,73	7,67	avarage			**27,53**
3,69	7,62	8,92	7,92	trimmed average			**28,31**
0,61	1,41	1,39	2,39	standard deviation			**4,95**
4	8	8	8	median			**28**
4	8	8	8	modus			**32**

4	10	10	8	a	A	cotBBW	**32**
4	10	10	10	a	A	cotBBW	**34**
4	8	9	7	b	B	cotBBW	**28**
4	8	8	4	b	B	cotBBW	**24**
3	6	8	8	c	C	cotBBW	**25**
4	8	10	7	c	C	cotBBW	**29**
4	8	8	8	d	C	cotBBW	**28**
4	6	10	6	e	A	cotBBW	**26**
4	7	10	6	e	A	cotBBW	**27**
3	8	8	8	f	A	cotBBW	**27**
4	8	10	10	f	A	cotBBW	**32**
4	8	8	7	g	B	cotBBW	**27**
4	8	8	8	g	B	cotBBW	**28**
4	10	10	10	h	A	cotBBW	**34**
4	10	10	10	h	A	cotBBW	**34**
3,87	8,20	9,13	7,80	avarage			**29**
3,92	8,23	9,15	7,92	trimmed average			**29**
0,34	1,28	0,96	1,68	standard deviation			**3,25**
4	8	10	8	median			**28**
4	8	10	8	modus			**34**

5	8	10	4	a	C	Coticule	**27**
4	8	10	6	a	C	Coticule	**28**
3	8	9	7	b	A	Coticule	**27**
3	8	8	4	b	A	Coticule	**23**
3	4	8	7	c	B	Coticule	**22**
3	6	10	8	c	B	Coticule	**27**
4	10	8	10	d	B	Coticule	**32**
4	8	10	8	e	C	Coticule	**30**
4	10	10	9	e	C	Coticule	**33**
3	6	8	8	f	C	Coticule	**25**
3	8	8	8	f	C	Coticule	**27**
3	8	8	6	g	A	Coticule	**25**
4	8	8	6	g	A	Coticule	**26**
3	8	10	10	h	C	Coticule	**31**
3	8	10	10	h	C	Coticule	**31**
3,47	7,73	9	7,40	avarage			**27,60**
3,38	7,85	9	7,46	trimmed average			**27,62**
0,62	1,44	0,97	1,89	standard deviation			**3,14**
3	8	9	8	median			**27**
3	8	10	8	modus			**27**