

Slicing Is Easier Not Because the Blade Gets Sharper but Because Its Angle Looks Smaller From the Direction of Motion

— Cutting with a **20-degree** blade while moving it sideways at λ times the push speed, the included angle seen along the motion becomes **14.214152** degrees at $\lambda = 1$, **6.382957** at $\lambda = 3$ and **3.961063** at $\lambda = 5$ — the separator is whether one asks about the edge’s roundness or about how the blade is moved — [Paper 860]

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Abstract

“A good knife cuts more easily when you slice” is common advice. This paper counts what changes when nothing about the blade is sharpened. No new theorem or law is claimed. First, pushing straight keeps the blade angle: **20.000000** degrees at $\lambda = 0$ (Section 2). Second, and this is the core. The more one slices, the smaller the angle seen along the motion: **14.214152** degrees at $\lambda = 1$ and **6.382957** at $\lambda = 3$ (Section 2). Third, one formula describes the shrinkage: the tangent of the half-angle is divided by $\sqrt{1 + \lambda^2}$ (Section 2). Fourth, an independent computation agrees: the angle between the face traces on the plane of motion matches the formula within 10^{-13} at all six values of λ (Section 3). Fifth, sliding at $\sqrt{3}$ times the push halves the tangent: the included angle is then **10.076738** degrees, with no sharpening (Section 3). Sixth, the separator is whether one asks about the edge’s roundness or about how the blade is moved: sharpening changes the blade; slicing changes how the blade is seen (Section 4). **Keywords:** blade angle, slicing, effective angle, wedge, geometry, model.

Scope of this paper (scope note): No new theorem or law is claimed: that slicing reduces the effective blade angle and that the relation is $\tan \theta_{\text{eff}} = \tan \theta / \sqrt{1 + \lambda^2}$ (the slice-push ratio effect) are known. No real cutting tool is claimed: a 20-degree blade is a model value matching no knife. Forces are not included: cutting force, friction and depth of penetration are not treated; only geometry. Foods are not treated: hardness and fibre direction are not the subject. Sharpening is not counted: the size of the edge radius is not counted; it is named only as one side of the separator. Relation to earlier papers: Paper 848 showed that an index dividing weight by the square of height moves with height even at the same build. This paper stands beside it: there the number moves with what one divides by, here the angle moves with the direction one looks from. In both, the object is unchanged and the number changes with how it is taken. Paper 300 showed that whether two things share a root is decidable: edge roundness and motion are distinct roots by that criterion. What is added is laying out the effective angle for six values of λ , confirming the formula by the independent route of face traces, confirming that $\lambda = \sqrt{3}$ halves the tangent, and placing the separator on edge roundness versus motion.

1. Notation and the Question

Setting: put the edge along the x axis and consider a blade of half-angle θ . The blade moves at unit speed in the push direction ($-z$) and at speed λ along the edge (x).

$$\tan \theta_{\text{eff}} = \frac{\tan \theta}{\sqrt{1 + \lambda^2}}, \quad \text{effective included angle} = 2 \theta_{\text{eff}}$$

Separately, the directions where the two face planes meet the plane spanned by the motion and the y axis are computed from the face normals, and the angle between them is found. Here the included angle is 20 degrees ($\theta = 10$ degrees).

Question: is slicing easier because the blade gets sharper?

2. The Angle Seen Along the Motion

Computation 2.1: the effective included angle was computed for several λ .

λ	effective included angle
0	20.000000 degrees
0.5	17.924782 degrees
1	14.214152 degrees
2	9.017551 degrees
3	6.382957 degrees
5	3.961063 degrees

Observation 2.2

this is the core. The more one slices, the smaller the blade looks. At $\lambda = 3$ it is 6.382957 degrees, below a third of the original 20: seen along the motion, the two faces are cut obliquely and the angle between them narrows.

Observation 2.3

the blade itself is unchanged. It is not sharpened and its edge radius is the same: only how it is seen has changed.

3. An Independent Route, and the Halving Point

Computation 3.1: the angle between the traces of the two faces on the plane of motion was computed and compared with the formula.

λ	angle from face traces	difference from formula
0	20.000000 degrees	2.49×10^{-14}
1	14.214152 degrees	1.78×10^{-15}
3	6.382957 degrees	4.44×10^{-14}
5	3.961063 degrees	1.64×10^{-13}

Observation 3.2

the two routes agree. One uses the tangent formula; the other takes cross products of face normals, sharing nothing in between, so the formula is simply the geometry of the blade seen along the motion.

Computation 3.3: the λ halving the tangent of the half-angle is $\sqrt{3} = 1.732051$, where the included angle is 10.076738 degrees.

Observation 3.4

motion does what sharpening towards half the angle would do. Sliding at 1.732051 times the push speed halves the tangent. Yet the edge radius is unchanged, so this acts differently from sharpening.

4. The Separator

Observation 4.1

the separator is whether one asks about the edge's roundness or about how the blade is moved. Sharpening changes the blade; slicing changes how it is seen: the single word "sharp" points at both a property of the blade and a way of using it.

Observation 4.2

placed beside Paper 848.848 showed that dividing weight by height squared moves with height at the same build. There the number moves with what one divides by; here the angle moves with the direction one looks from. The object is unchanged in both, and the number changes with how it is taken. Paper 300 showed that whether two things share a root is decidable: edge roundness and motion are distinct roots by that criterion.

Observation 4.3

what is not said. Real knives, cutting force and friction, foods and the size of the edge radius are not treated. What is shown is that slicing makes the angle look smaller without making the blade sharper.

5. Census and Closing

1. **pushing: 20.000000 degrees** (Computation 2.1): **the blade angle itself.**
2. **$\lambda = 1$: 14.214152 degrees** (Computation 2.1): **smaller.**
3. **$\lambda = 3$: 6.382957 degrees** (Computation 2.1): **the core.**
4. **$\lambda = 5$: 3.961063 degrees** (Computation 2.1): **smaller still.**
5. **not sharpened** (Observation 2.3): **only the view changes.**
6. **face traces match the formula** (Computation 3.1): **within 10^{-13} .**
7. **nothing shared in between** (Observation 3.2): **independent routes.**
8. **$\lambda = \sqrt{3}$ halves the tangent** (Computation 3.3): **10.076738 degrees.**
9. **motion is not sharpening** (Observation 3.4): **radius unchanged.**
10. **edge roundness, or motion** (Observation 4.1): **the separator; Papers 848, 300.**

Closing: Slicing is easier not because the blade gets sharper but because its angle looks smaller from the direction of motion. Moving a 20-degree blade sideways at λ times the push speed gives an effective included angle of 14.214152 degrees at $\lambda = 1$, 6.382957 at $\lambda = 3$ and 3.961063 at $\lambda = 5$: seen along the motion, the two faces are cut obliquely and the angle between them narrows. The relation agrees within 10^{-13} with the independent route through the face normals, and $\lambda = \sqrt{3}$ halves the tangent of the half-angle exactly, because the formula is the blade's geometry seen along the motion. Throughout, the blade was never sharpened and its edge radius never changed. Placed among the earlier papers: beside Paper 848's "the number moves with what one divides by", as "the angle moves with the

direction one looks from”, and treating edge roundness and motion as distinct roots by the criterion of Paper 300. To be honest: only geometry is examined; cutting force, friction and the food are not included.

References

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