

When Can You Pick Up Fallen Fruit?

“Behavioral Despair in the Talmud:
New Solutions to Unsolved Millenium-Old Legal Problems”
Forthcoming in the Asian Journal of Law & Economics

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Ancient oral law recorded in the Talmud: fruit must be *scattered*, not in a pile, so we can deem it abandoned.
How scattered? “Two dozen pieces over 4 square feet.” (“One *kav* over an area of four *amot*.”)

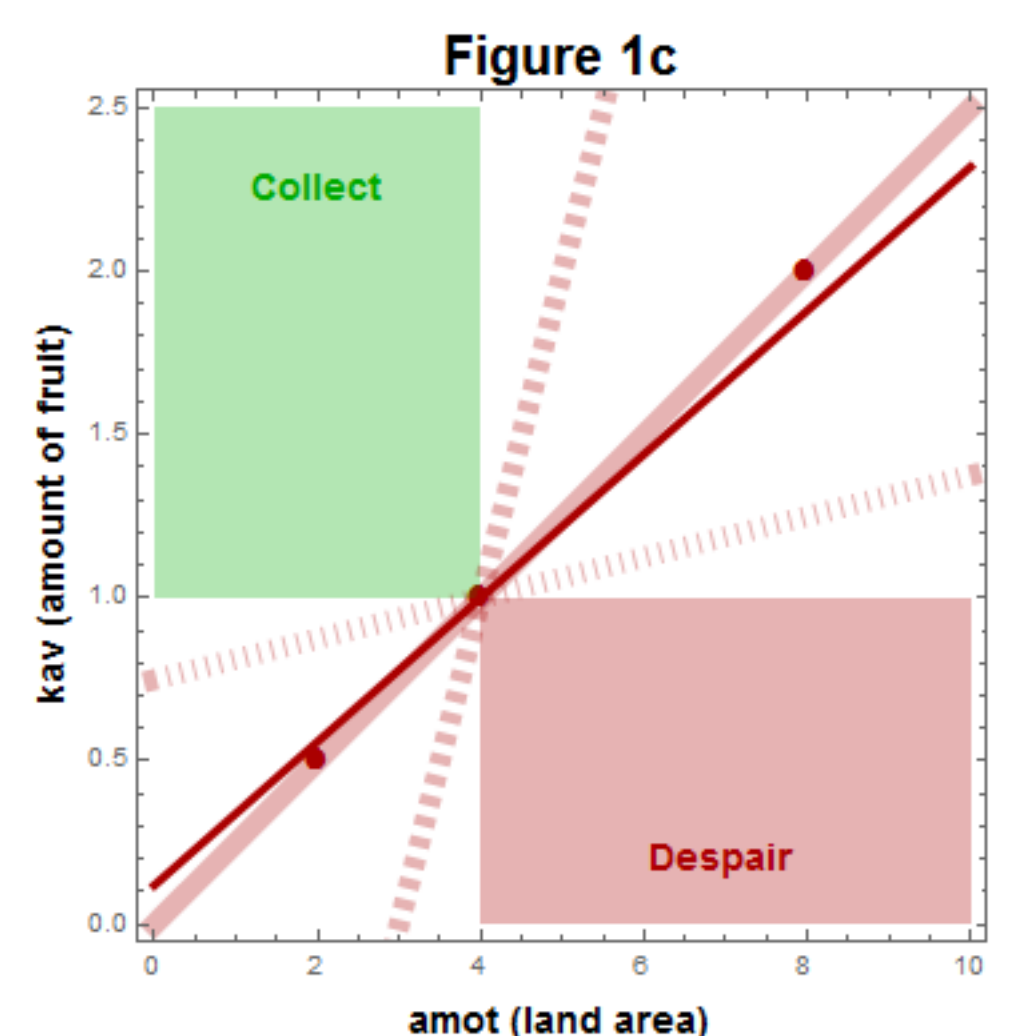
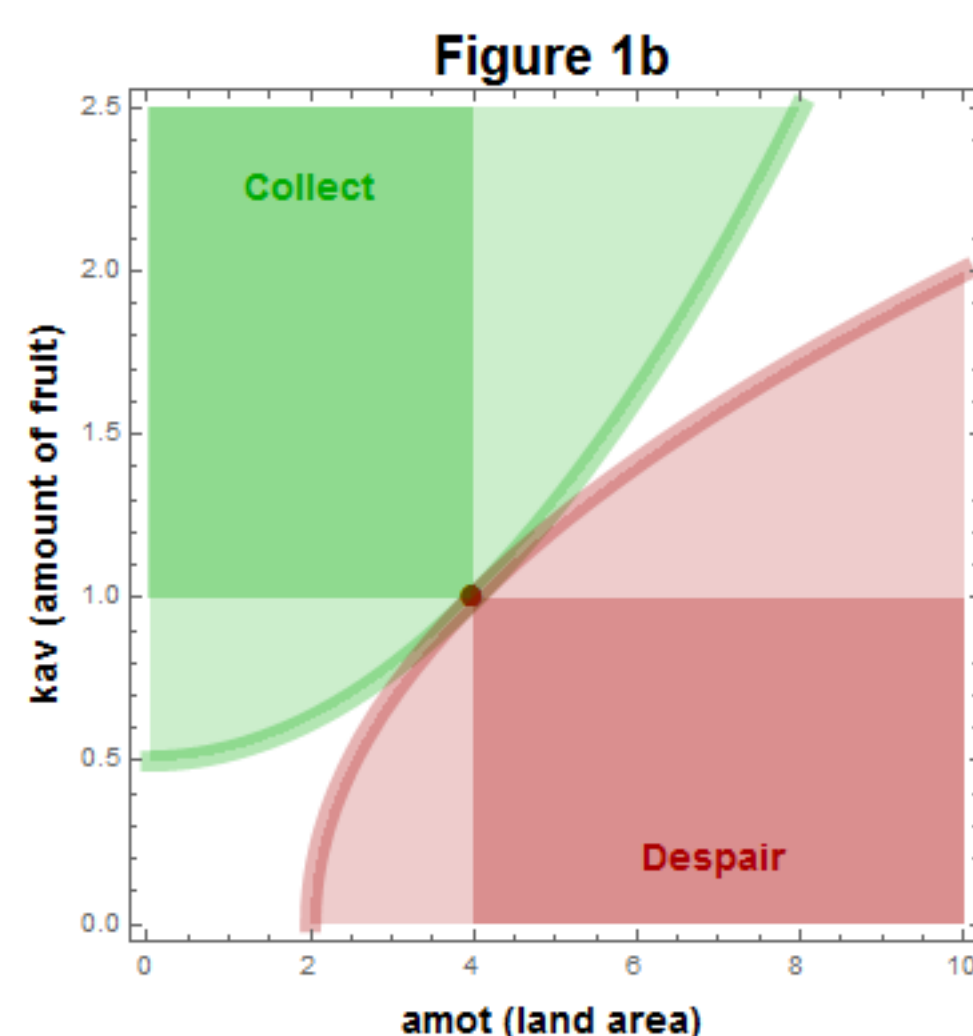
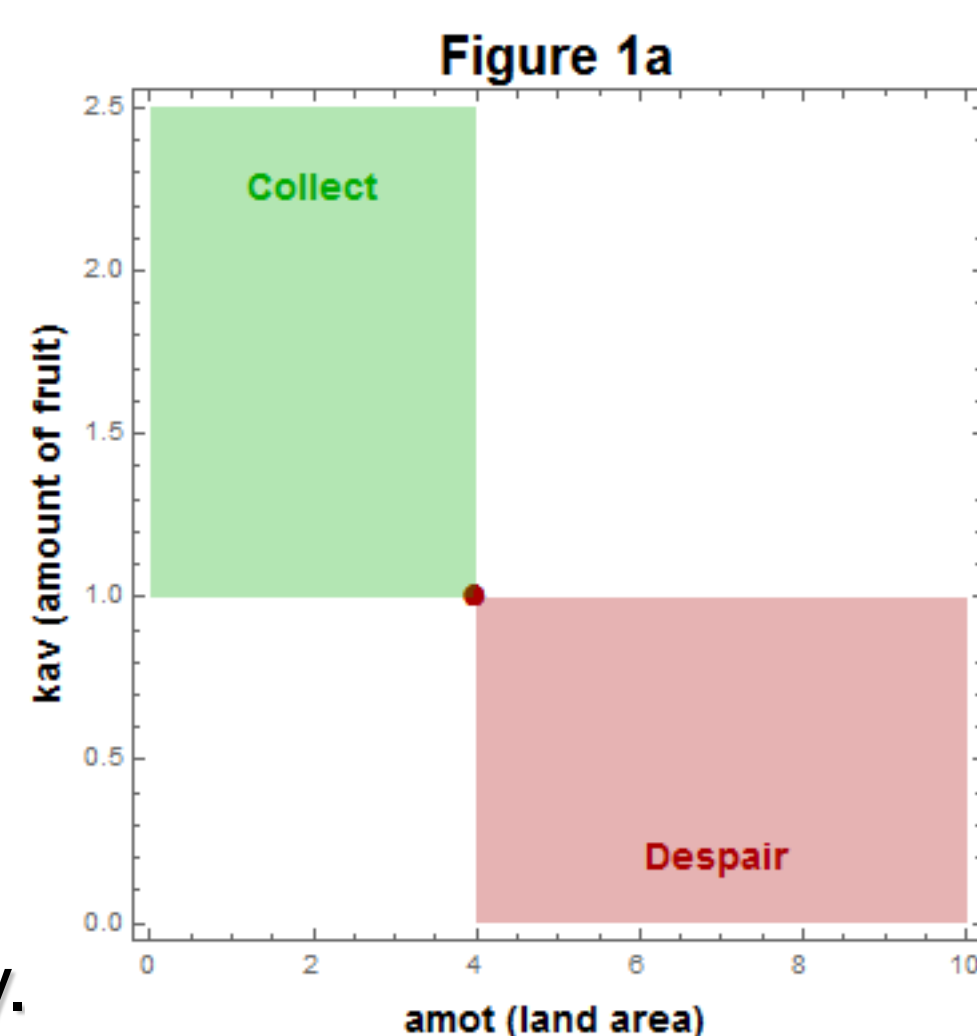


Why? Two theories in the Talmud:

Too little fruit for original owner to worry about
Too much effort to collect over that area
What about one dozen over 2 square feet?
It’s even less fruit! So yes, you can eat it.
But: it’s less work. So no, you can’t eat it.
What about four dozen over 8 square feet?
It’s more fruit. So no, you can’t eat it.
But: it’s more work. So yes, you can eat it.
Talmud concludes: **TEYKU** *Unsolvable*
Continuous commentary on this issue for the past 1,500 years without a solution

We Solve the
Unsolvable!
In a Talmudic way

We only use assumptions the Talmud would acknowledge.
We do *not* rely on any kind of utility function or even rationality.



- A1 Assumption of Decision:** $f_i(k, a) \in \{0,1\}$ for all k, a .
- A2 Assumption of More-is-Better, Less-is-Worse:**
 $f_i(k^*, a^*) = 0$ implies $f_i(k, a) = 0$ for all $k \leq k^*$ and $a \geq a^*$
 $f_i(k^*, a^*) = 1$ implies $f_i(k, a) = 1$ for all $k \geq k^*$ and $a \leq a^*$.
- A3 Assumption of Scale:** The set of all possible pairs of k and a is: $R_2^+ = \{(k, a) : a \geq 0, k \geq 0\}$
- A4 Midpoint Continuity:** If (k_1, a_1) and (k_2, a_2) belong to D (or C), then the midpoint between these two points $((k_1 + k_2)/2, (a_1 + a_2)/2)$ also belongs to D (or C , respectively).
- A5 Despair Over Negligible Fruit:** All owners will despair over a de minimus amount of fruit regardless of the amount of land area: $f_i(\epsilon, a) = 0$ for all a .

Figure 1a: this is the oral law. If the fruit’s original owner would despair over two dozen pieces on four square feet, they will despair over more land or less fruit. If they would collect two dozen pieces, they would collect over less land or more fruit.
Figure 1b: this is a particular person. Perhaps they collect along the green curve and despair along the red.
Figure 1c: every point must have a decision. So the two curves must intersect. A convex and concave curve can only intersect as a line. And the line must be to despair when there is hardly any fruit over zero area.

Conclusion: One dozen over two square feet is sufficiently scattered; you may pick it up.
Four dozen over eight square feet is insufficiently scattered; you may not pick it up.

Extension: Two other *teyku*’s in the Talmud ask: what if the fruits are pomegranates instead of apples, or grain of various varieties. With one other reasonable assumption, that of a known minimum wage for the original owner, we can answer these two other *teyku*’s as well!

Behavioral Insights: The Tosafot, a medieval-era commentary on the Talmud, argues that people may be irrational. Our results support this early (earliest?) behavioral insight.

Generalizations and Applications: Who cares about fruit?! But this question and our solution applies to *any* situation where we want to predict an entity’s action based on only *one* data point on the boundary. Applications include individuals, organizations, and nations.