Castle Economics

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Even though economics as a formal scientific discipline is little more than 200 years old, there is no shortage of evidence that people all over the globe have had a keen understanding of, and appreciation for, economic principles for hundreds, indeed thousands, of years. For example, the Rosetta Stone is a "Proclamation of Peace" issued around 200 B.C. by King Ptolemy V to resolve civil unrest in Egypt. Of enormous import at that time, the proclamation restored ancient, significant tax immunities to religious temples that had been lost when Egypt was conquered by the Assyrians, the Persians, and finally the Greeks (Adams, 1993). More recently, steadily increasing economic tensions between English barons and the Crown were resolved in principle by the signing of the Magna Carta by King John and members of the nobility in 1215. In this note, I identify a hitherto unappreciated application of economic principles in a historical context: the construction of medieval castles.

Medieval castles are marvels of defensive warfare. Stone towers built with arrow slits typically guarded both sides of one or more entry gates fitted with a drawbridge and double portcullises. Narrow to the outside, the arrow slits afforded 90 degree or more shooting range from the inside, for maximum killing efficiency. Appropriately-termed "murder holes" above the gateway entrance permitted defenders to pour scalding liquids or rain arrows down on attackers massed against the second portcullis after breach of the first one. Multi-story towers were built at intervals along outer walls. In times of peace, they served a number of functions, including living quarters, but when the castle was attacked, they permitted

the defenders to guard the wall from both sides, as well as from above, against being scaled.

One can still observe application of a specific economic principle in the design and construction of these towers. The towers were at least two stories tall, with three or more stories being typical of the major castles (e.g., Warwick, Chepstow, Caerphilly, Caernarfon, Conway, Kenilworth). Access to the upper levels was by means of an interior spiral stairway, made of stone. The builders, interested in defence, had the option of building spiral staircases that ascended in a clockwise manner or in a counter-clockwise manner. Did the direction of ascension matter to castle defenders? Indeed it did.

Both attackers and defenders wielded swords, pikes, maces, crossbows, etc. The typical individual was right-handed. Spiral staircases that ascend in a clockwise manner around a stone central support place right-handed attackers at a distinct disadvantage relative to right-handed defenders. As can be seen in Figure 1, the right-handed defender fighting in a clockwise-ascension spiral staircase has maximum freedom to manoeuvre his sword-arm.[1] This permits him to defend either from a wide variety of different lateral angles against a single attacker or against multiple attackers. Further, the ability to swing his arm around the arc of the stairway's outer wall also maximizes the angle of the defender's vertical defence. Not only can he manoeuvre his weapon to parry specific thrusts made by the attacker, he also can attack just about any point of the aggressor's body.[2]

At the same time, the defender is protected, to some extent, by the stone that forms the central support for the spiral stairway. This central support significantly limits both the angles of attack and defence available to the aggressor, because it restricts the lateral movement of his right hand (Figure 2). Per degree of lateral arc, a right-handed attacker must expose more of his body than a right-handed defender on a clockwise-ascension spiral stair. This implies relatively more bodily protection for

[1] The defender looking down a clockwise ascension spiral stairway sees it curving in a *counter-clockwise* direction.

[2] The defender also has the advantage of fighting *down* the stairwell, which is less tiring than fighting up the stairwell because it requires less lifting of one's weapon.

the defender than the attacker and also relatively more opportunity for the defender to stab his opponent(s) than vice-versa.

Builders of castles designed and constructed the spiral stairways in castle towers to their maximum advantage. The direction of ascension is not distributed randomly (i.e., 50/50). Rather, 7 of every 8 spiral stairways were built to ascend in a clockwise direction. This matches

FIGURE 1 - The Tower Defender

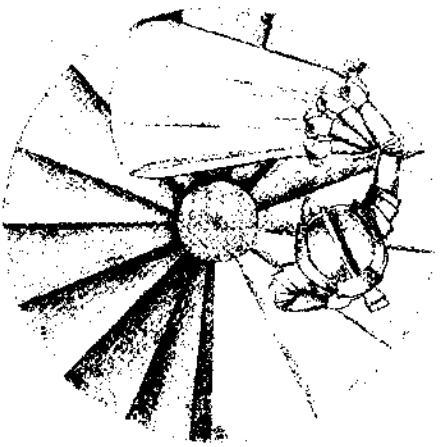
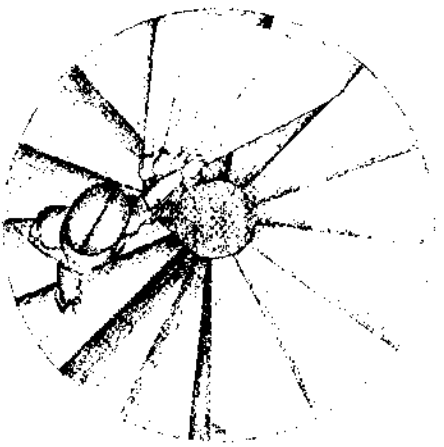


FIGURE 1 - The Tower Attacker



the ratio of righthanders to lefthanders that occurred naturally in the population. The curvature favours left-handed attackers and right-handed defenders. Since there were so few left-handed attackers, relatively speaking, the marginal advantage was captured by the defenders, by virtue of intelligent structural design.

This implies that left-handed attackers would be regarded as more valuable, *ceteris paribus*, than right-handed attackers. Consequently, we can in retrospect predict that intelligent commanders assigned left-handed fighting men the task of attacking towers. At least then, the marginal advantage held by the defenders was lessened somewhat.

Left-handed defenders were, of course, subject to the same disadvantages as right-handed attackers in a clockwise-ascending spiral stairway. Against right-handed attackers, left-handed defenders enjoyed no marginal advantage; left-handed defenders actually were at a marginal disadvantage when facing left-handed attackers in a clockwise ascension spiral stairway. On balance, then, left-handed defenders in a clockwise-ascension tower spiral stair were disadvantaged. The solution: every eighth spiral stairway was built to ascend counter-clockwise and be defended by left-handed men. These defenders had no marginal advantage over right-handed attackers but did enjoy a marginal advantage over left-handed attackers. Thus, the defenders of these towers had a net advantage over attackers, *ceteris paribus*.

Caernarfon Castle in north Wales was designed by Master James of St George at the request of King Edward I of England. Construction was begun in the year 1283. Every eighth tower is ascended by means of a counter-clockwise spiral stairway; the remainder contain clockwise-ascension spiral stairways. It is altogether clear, in retrospect, that both men understood and appreciated the principle of marginal advantage. It should, therefore, come as no surprise to find out that the monarch reigned for 35 years (1272 - 1307).

REFERENCES

ADAMS C., *For Good and Evil: The Impact of Taxes on the Course of Civilization*, Madison Books, New York, 1993.