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THE JOINTS NOBODY SEES

THE HIDDEN JOINERY OF HORYUJI

In Ikaruga, outside NARA, a five-story PAGODA has stood for roughly thirteen centuries. Part of the temple complex at Horyuji, it is among the oldest surviving wooden buildings in the world, and almost none of the carpentry holding it up is visible. The joints are buried inside the timbers, cut so that two pieces lock by shape alone. CARPENTERS trained to build and repair such halls are called MIYADAIKU, temple carpenters, taught hand to hand over decades rather than from books. Their finest work is sealed inside, where no visitor will ever look.

SPELL Spell: MIYADAIKU

MIYADAIKU

SPELL Spell: CARPENTERS

CARPENTERS

KNOWN What is the five-story tower at Horyuji, standing for some thirteen centuries, called?

PAGODA

KNOWN Ikaruga sits just outside which city?

NARA

OPEN The best work in that building is sealed inside where nobody will ever see it. What is something you would do well even if no one could check?

Open response - use practitioner judgment

TWO FAMILIES OF JOINTS

Japanese carpenters sort their joints into two families. TSUGITE are splices, joining two timbers end to end so that a long beam can be made from shorter ones, or a rotten foot cut away and a sound piece let in. SHIGUCHI are the connections where members meet at an angle, post to beam or beam to beam. Neither family needs nails or glue. A MORTISE is chopped into one piece, a TENON cut on the other, a DOVETAIL flares so it cannot pull straight out, and a HARDWOOD WEDGE drives the assembly tight.

SPELL Spell: TSUGITE

TSUGITE

SPELL Spell: SHIGUCHI

SHIGUCHI

SPELL Spell: HARDWOOD

HARDWOOD

SEMI_OPEN Name two of the cut shapes that lock a joint together without nails or glue.

NEEDS 2 OF MORTISE / TENON / DOVETAIL / WEDGE

OPEN A rotten foot of a post can be cut away and a sound piece let in. What is something you own that you would want mended instead of replaced?

Open response - use practitioner judgment

MATH Suppose a carpenter splices a four-meter timber to a three-meter timber, and the overlap of the splice takes up one meter. How many meters long is the finished beam?

6

MARKING THE WOOD

The wood is usually HINOKI, a slow-growing Japanese CYPRESS prized because it is straight-grained, aromatic, and stubbornly resistant to rot. Nothing is cut until it is marked. The carpenter snaps guide lines with the SUMITSUBO, an ink pot holding a soaked line on a reel, and every cut afterward answers to those lines rather than to a fresh measurement. Only then do the cutting tools come out: a SAW that bites on the pull stroke, a CHISEL for clearing waste, an ADZE for roughing a face, and a PLANE, likewise drawn toward the body.

SPELL Spell: SUMITSUBO

SUMITSUBO

SPELL Spell: HINOKI

HINOKI

SPELL Spell: CYPRESS

CYPRESS

SEMI_OPEN The carpenter keeps four cutting tools for shaping the marked wood. Name two of those tools.

NEEDS 2 OF SAW / CHISEL / ADZE / PLANE

OPEN The saw and the plane both cut while being pulled toward the body instead of pushed away. What do you think that pulling motion would feel like?

Open response - use practitioner judgment

TAKING IT APART

Hidden work cuts both ways: a joint nobody sees is also a joint nobody can check. The tradition's answer is that buildings come apart. Every few generations a temple is dismantled down to its members, and the damage done by ROT, INSECTS, EARTHQUAKES, and WEATHER is read out of the timbers one piece at a time; decayed sections are spliced out and the frame goes back up. ISE JINGU goes further, rebuilding the shrine on a fixed twenty-year cycle called SHIKINEN sengu. The sixty-second rebuilding came in 2013, leaving a shrine both ancient and new.

SPELL Spell: SHIKINEN

SHIKINEN

SPELL Spell: JINGU

JINGU

KNOWN Which named Jingu, the shrine rebuilt on a fixed twenty-year cycle, sits at the far end of this tradition?

ISE

SEMI_OPEN**Name two of the forces that damage a wooden building over time.**NEEDS 2 OF **ROT / INSECTS / EARTHQUAKES / WEATHER****OPEN****When a temple is taken apart down to its separate pieces, which piece would you most want examined first?**

Open response - use practitioner judgment

MATH**The shrine at Ise is rebuilt every twenty years. How many rebuildings happen over three hundred years?**

15

WHAT YOU CANNOT SEE

You own a version of this problem already. Wood never stops moving: as it dries and as HUMIDITY swings, a board loses and regains width across the grain, a change called SHRINKAGE, and anything glued or screwed rigidly against that movement eventually splits or works loose. A dovetail cut to slide, a tenon fitted to breathe, a wedge that can be knocked back out - these let a thing be taken apart and put back together instead of thrown away. The next time a drawer still runs sweetly after GENERATIONS of use, look at what you cannot see.

SPELL**Spell: GENERATIONS****GENERATIONS****SPELL****Spell: HUMIDITY****HUMIDITY****KNOWN****What is the term for the way a board loses and regains width across the grain as the air dries and dampens?****SHRINKAGE****OPEN****What object would you most want to take apart to see how it was put together?**

Open response - use practitioner judgment

MATH**Suppose a drawer front measures 200 millimeters across the grain and dry air shrinks it by 3 percent of that width. How many millimeters narrower does it become?**

6