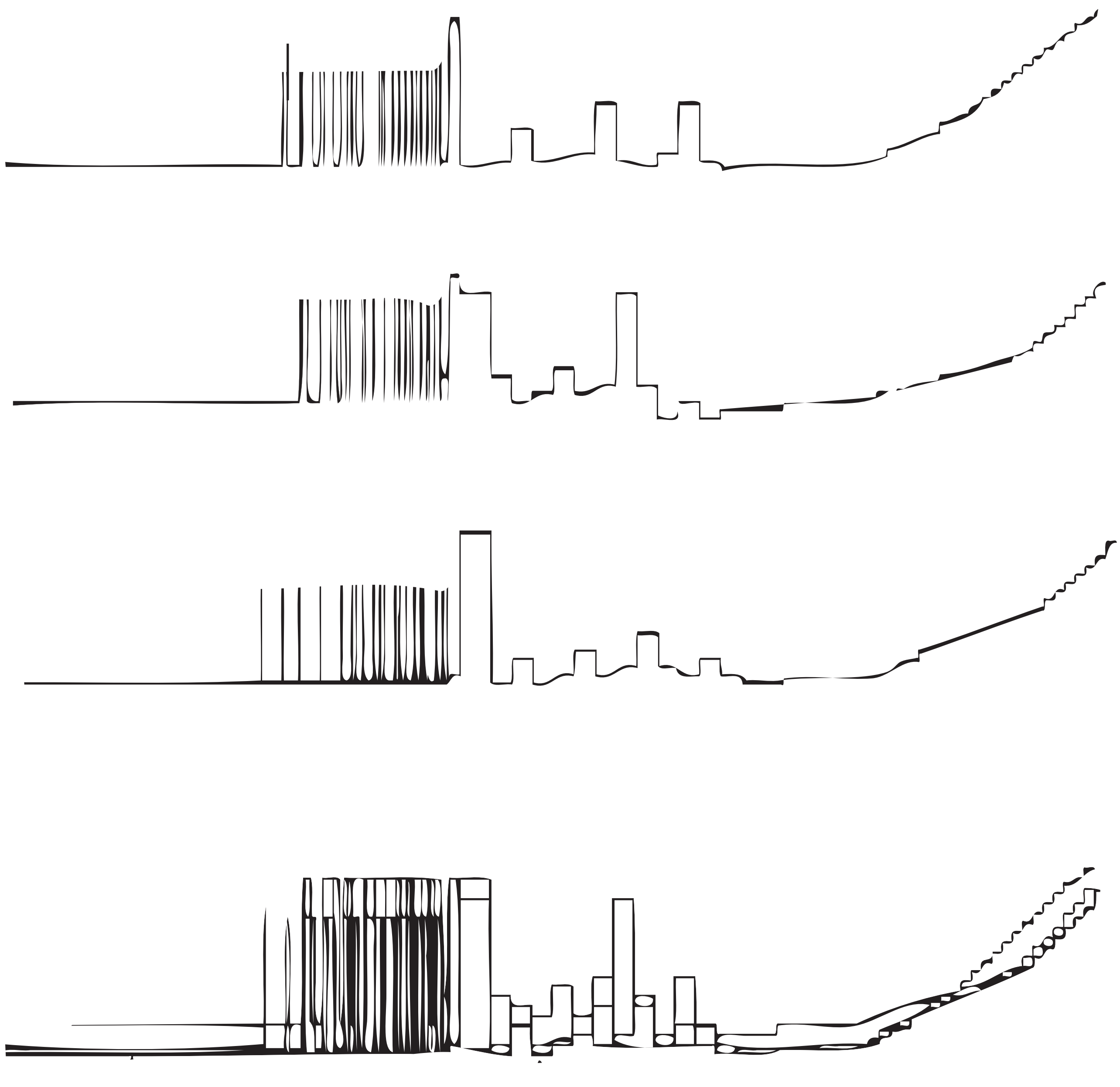
score / technique / specification

dice roll (2014)
nolan lem



www.nolanlem.com



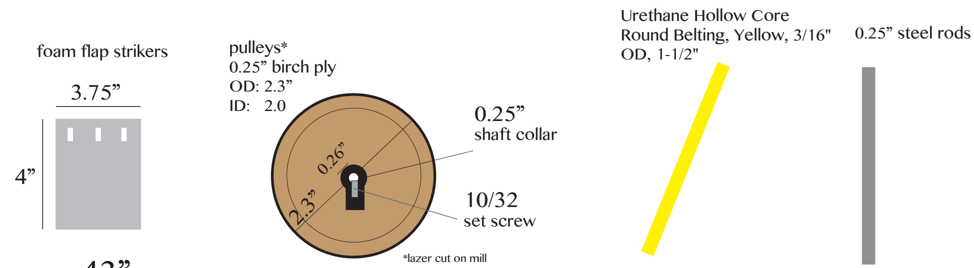

d i c e   r o l l

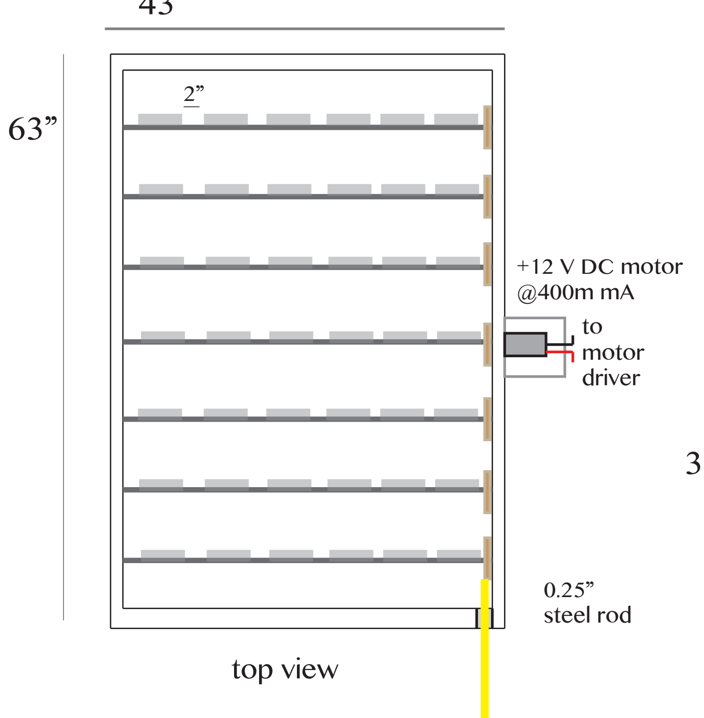
dice, plywood, metal, fishing line, motors, foam paper, wood, pulleys, electronics

This kinetic sculpture is comprised of four machines, each controlling a network of autonomously rolling dice. Different ensembles of dice interact rhythmically in the composition of sound where they explore a perceptual continuum that investigates the boundaries between order and chaos, pattern and noise, equilibrium and entropy.

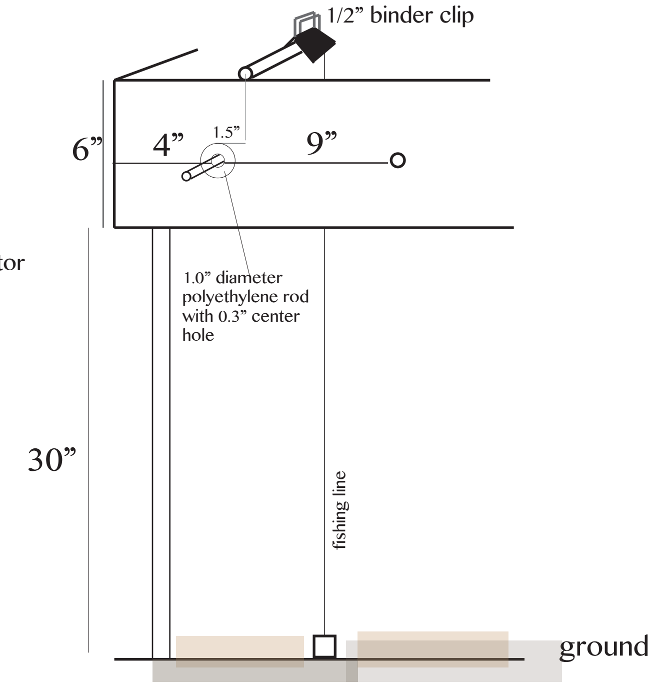
Casting the dice as culturally-specific sound objects associated with gambling, probability, and chance, these large kinetic machines reveal the dense sonic timbres of rolling masses en masse. Often approximating the natural sounds of rail or hail, the emergence of the dices' sonic presence in sheer volume and aggregated mass pervades the space suggesting an indeterminate world comprised of richly volatile probabilities.

material specifications: modular dice structures (5)



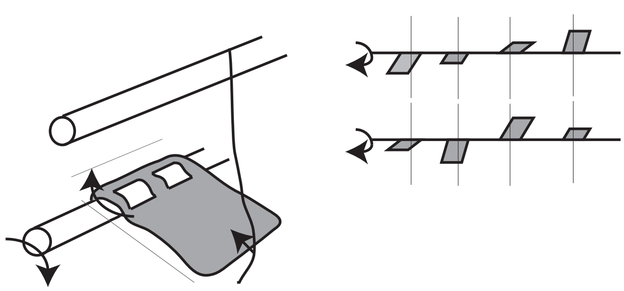


top view



side view

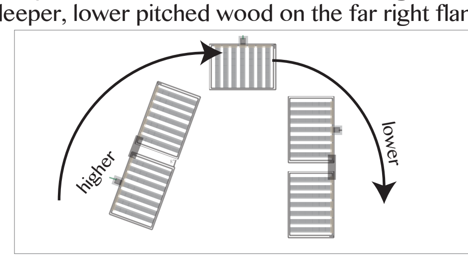
about phase drift



the foam flaps strike the line fixed to the dice and slip (and rotate about the rod) changing the articulation of the phase of the dice on the rotating row. This type of phase slippage is a function of the angular frequency of the motor and the angular frequencies of the other strikers. It accounts for the variability of dice articulations (rhythms) per each structure. The dice go in and out of phase with one another, forming new rhythms that emerge and dissipate. @ 250 rpm, all in phase: 4.2 Hz

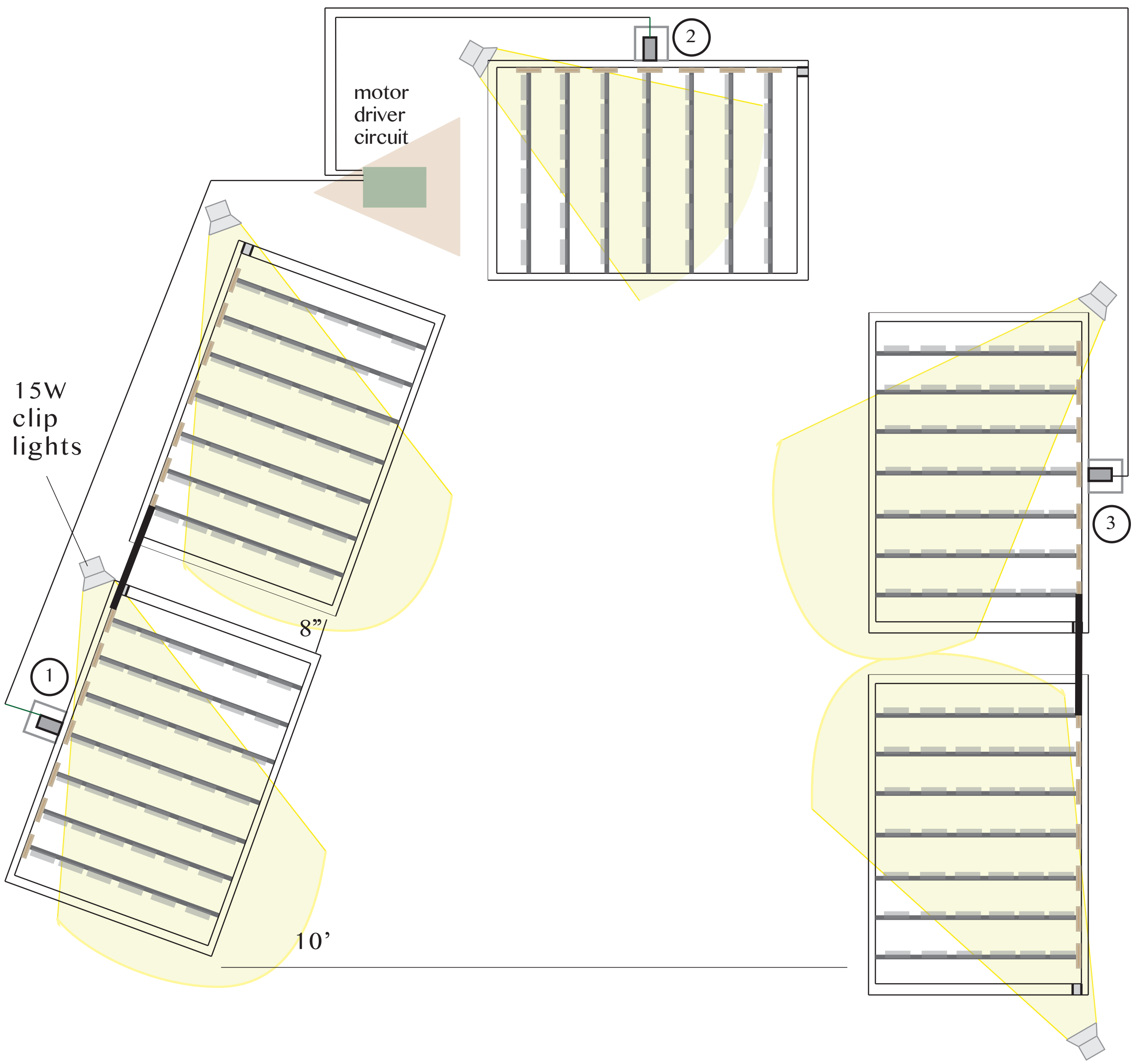
wood specifications

Any type of wood can be used to sound the dice. The wood used on the ground of the installation floor was arranged with respect to pitch: higher pitched wood (generally smaller and thinner and/or more dense) was placed on the left flank and forms a gradient with deeper, lower pitched wood on the far right flank.



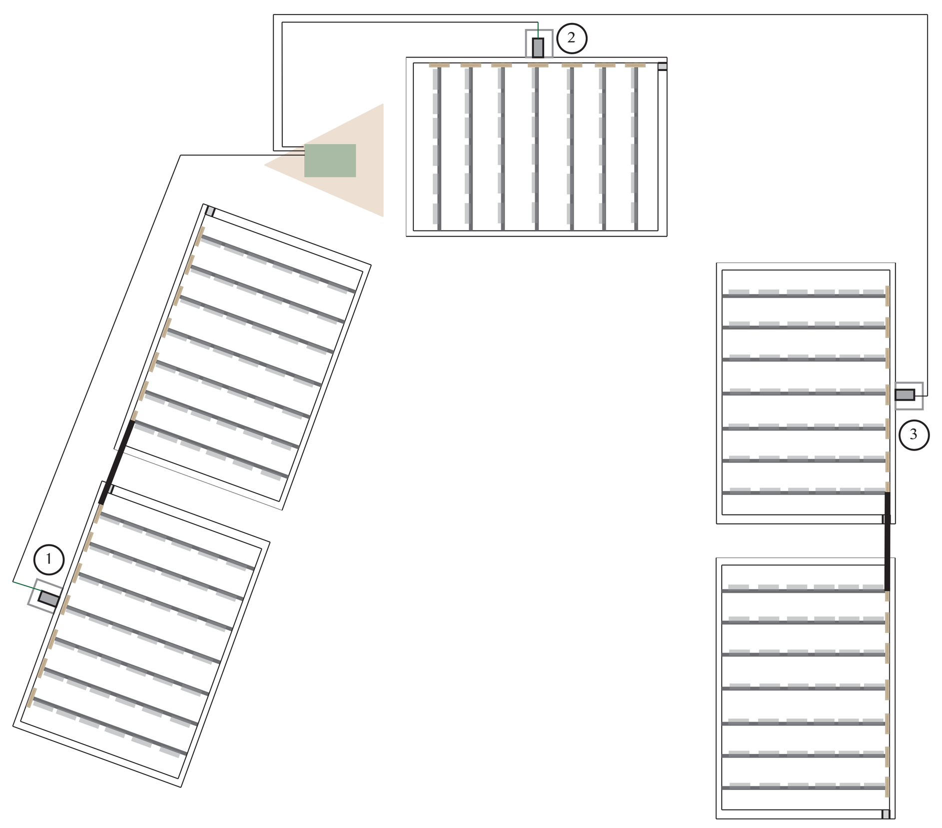
pitch mapping wood blocks spatially

installation layout



score

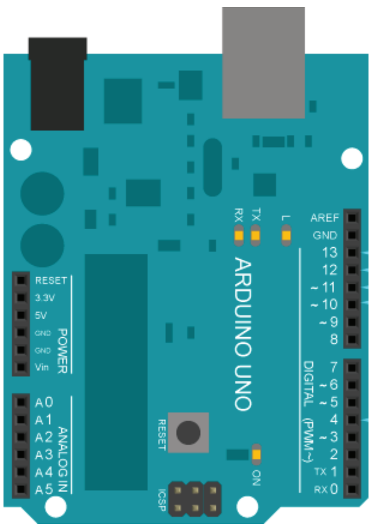
orientation layout



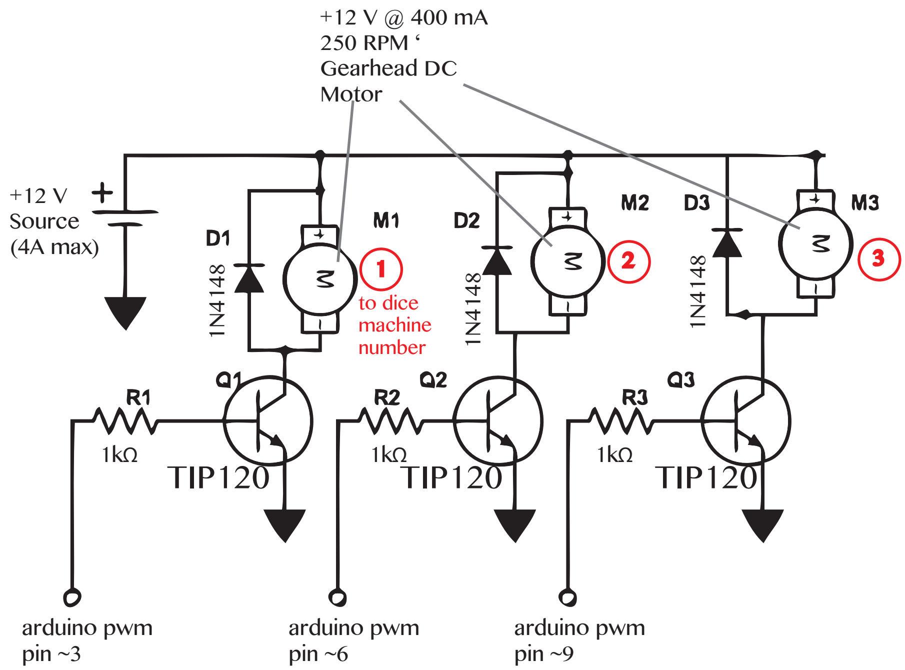
This plot shows the density contour of dice articulations with respect to the 3 motors that power the 5 modular dice structures. The motors' revolutions per minute (RPM) are proportional to the applied voltage: a higher voltage compels the motor to spin more rapidly with a maximum RPM of 250 achievable at +12 V. This chart shows the four main sections of the density loop: the **quiet** period, **impulse** period, **ramp** period and **crescendo** period. The motors are provided with a pulse width modulated input voltage that is integrated (by the motor) itself to acheive the control voltages shown above.

motor driver circuit

the motors are controlled using and Arduino UNO and a simple motor driver circuit. The motor driver circuit was built to be inserted into the arduino as a 'shield' that lays atop the microcontroller. It runs from a +12 V source capable of deliver up to 4 A.



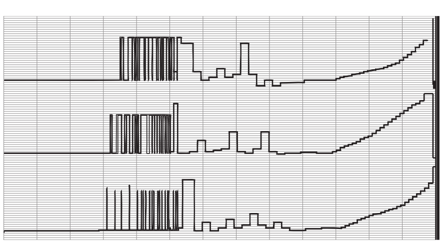
arduino UNO - assigned 3 pwm output pins



motor driver circuit schematic

arduino code

please see www.nolanlem.com/installations/diceRoll/code.html
to see the code



density contour plot

The arduino code uses several user defined functions to create separate timers and counters to control how the motors rotate over time and hence, how the dice are articulated and sounded. In general, the duty cycle of the PWM output is modulated to produce a range of output voltages (that are then powered by the driver circuit) that control the RPM of the motors. Both static, instantaneous, and ramping control voltages are produced to create the density contour plot shown in the score.