Modeling with Motion Scale Model Animation

Presented by Geoff Bunza
My Animation Influences

Disneyland Great Moments with Mr. Lincoln
Grabs and Holds the Imagination

Pendon Museum (Long Wittenham, Abingdon, Oxfordshire, U.K.) preserves the idyllic rural scene and transport of the 1920s and 30s (pendonmuseum.com)

The Model is the Story
What Makes Something Appear to Be Alive?
Animated versus Animation

You can create animated features
Blinking lights, Body movements, etc.

When creating an animation consider the whole:
• Movement
• Light
• Sound
• Synchronization
• Story
Movement

- **Circular** (likely continuous)

- **Linear** (movement along a line, possibly with pauses and reversals)

- **Steered** (forced path by track, trough, or other means)

- **Guided** (Intelligently steered without obvious constraints)

- **Random** (arbitrary, chaotic, non-repeating)
Drives for Movement

Right Angle Drive Gearmotors

Planetary Gearmotors

Gearmotor

Vibrator Motors

Micro Stepper Motor

Screw Drives

Belt or String Drive

HiTec HS-55

LS-0003
Motors and Gears
Simple Rotation One Direction

- 2mm Brass Tube with 2-56 Threaded End
- 2.5mm Guide Tube
- Hole Tapped for 2-56 Thread
Simple Rotation One Direction
Gear Reduction Drives
“Bring a Wrecking Crane to Life” Model Railroad Hobbyist August 2012
http://tinyurl.com/mjtwdp4
Gear Drive Mounting Alternatives
“Invite a Flock of Animated Cranes to Your Layout”
Model Railroad Hobbyist, To Be Published Q4 2015
Screw Drives
Stall Motors
Belts and Bands
“A Visit to Bob’s Barber Shop – Animation in HO Scale”
Railroad Model Craftsman. To Be Published
Band Drive
Hammer and Anvil

- 6mm Planetary Drive Motor
- 0.012 Wire Linkage to Arm
Hammer and Anvil
Turning DC Motors On

- Switches
- Transistor Switch: Hi In – Low Out
- Magnetic Reed Switch
- IR Proximity Sensor
- Hall Effect Magnetic Sensors
- Sensors (Environmental Switches)
- Relays (5V & 12V) (Switch on a Switch)
- L298N Dual H-Bridge
- DCC Decoders
Servo Motors

3-Wire Control:
1. 4.5-6.0 Volts DC
2. Common/Ground
3. Control Signal (Pulse Train) 50 Hz / 20ms Duration
Example: Servo Drivers

- Arduino Button Control* (About $5)
- Arduino DCC Multifunction Decoder Control** (About $5)
  ** http://model-railroad-hobbyist.com/node/20739
- TAM Valley Octopus III
- Team Digital SC8
- The Proto:87 Smartswitch

*Program “Clinic_ServoTestSet_4_switched_slow.ino” is in:
http://home.comcast.net/~gbglacier/Clinics/AnimationControl_Clinic_adds.zip
Servo Door Openers
Stepper Motors

Stepper Motor

Geared Steppers

Miniature Stepper w/Screw Drive

4, 5, 6 - Wire Control:
1. 4-12 Volts DC
2. Complex Sequencing
3. Pulsed & Polarity Reversals (Bi-Polar & Unipolar)
Stepper Motor Control

4,5,6 - Wire Control:
1. 4-12 Volts DC
2. Complex Sequencing
3. Pulsed & Polarity Reversals (Unipolar & Bi-Polar)

Arduino Pro Mini

L298N Dual H-Bridge
Gearmotor/Servo/Stepper Issues
Timing, Cueing, & Synchronization

- Consider Animation as a sequence of actions
  - Move this…
  - Play these sounds…
  - Set this speed…
  - Turn this light on… off… on… …
  - Wait so long…
  - Wait until something happens…
- How does an action start?
- What are the delay times among actions?
- How are the actions coordinated?
- How does an action end?
**Triggers & Cueing**

- A **Trigger** is a detectable change
  - Switch closure: *metal contacts, push button, switch*…
  - A sensor change: *optical sensor, magnetic sensor*…
  - The end of a timer: *mechanical or electrical or program*

- A **Timer** is some mechanism that has a known delay

- A **Sequencer** provokes one or more actions at different time intervals

- **Cueing** is the coordinated *start* of multiple actions—like movement start and sound generation

- Action ends with:
  - Completion of sequence
  - End of time period
  - Ending trigger
  - No end – continuous loop
Mechanical Timing & Sequencing
Mechanical Timing & Sequencing

Brass Drum

Battery

Start Button

MOTOR

Insulating Tape

Contact Wipers

Resistors

LEDs

Start Button Moves Drum Off "Stopping" Tape
Wipers Close the Circuit to the LEDs
Scripted DCC Control

• JMRI
• JMRI/Jython Scripts

```python
### Set Speed to Forward, stopped
self.throttle.speedSetting = 0.
sself.throttle.setIsForward(True)
sself.waitMsec(self.delay*400)

# F8 on, forward
self.throttle.setF8(True);
sself.throttle.setIsForward(True)
sself.waitMsec(self.delay*50)

# F6 rear light on
self.throttle.setF6(True);
sself.waitMsec(self.delay*500)

# Mute (F8) off
self.throttle.setF8(False);
sself.throttle.setIsForward(True)
sself.waitMsec(self.delay*1000)

# Whistle
self.throttle.setF2(True);
sself.waitMsec(self.delay*500)
sself.throttle.setF2(False);
```
Programmed Timing & Sequencing

• Why Bother?
  – Way More Flexibility Than ANY other Method
  – Low Cost
  – Easy to Modify/Change

• Multiple triggers
• Multiple Kinds of Triggers
• Lights, Motors, Relays, Servos, Sensors
• Pseudo Random Sequencing
• Different Sequences Can Run Simultaneously
• DCC Library Already Written
• Support For Sound Generators (MP3, WAV & AD4)
• Additional Tutorials, Books, Libraries, Examples
• Low Power for Battery Applications & On-Board Loco/Car Animation
Programmed Timing & Sequencing

Arduino Pro Mini
- $3.84
- $2.59!! Qty 1
- http://tinyurl.com/oamynj5

Digispark
- $3.84
- $2.59!! Qty 1
- http://tinyurl.com/oamynj5

Arduino Uno
- $11
- $30 Qty1

Atmel 328P on SurplusGizmos.com
- Atmel Lite Kit $6.75 Kit Only

Alternatives:
- Atmel ATMega328P
- Mouser.com $2.24 Qty1
- http://www.arduino.cc
- http://sparkfun.com
- http://www.adafruit.com

Solderless Breadboard
The Essentials for Programmed Sequencing

Arduino Pro Mini-$2.59
http://tinyurl.com/oamynj5

PLUS

USB to Pro Mini Cable-$6.88 (Need One)
http://tinyurl.com/ld6sgy3

Download Software for FREE
http://arduino.cc/en/Main/Software
http://www.arduino.cc/

An Arduino Cookbook for Modelers:
Starting from Scratch with an Arduino Pro Mini (or Moteino)
Now Combine Sensors and Control

Wire-Guided Mobile Crane
What Model Drives Were Left Out?

1. Solenoids
2. Spring Drives
3. Ultrasonic Piezoelectric Motors
4. Nichrome Wire
5. Miniature Gas Engines
6. Miniature Live Steam Engines
7. Miniature Jet Engines
8. Elastic Drives
9. Muscle Wire
10. Pneumatic Piston Drive
11. Hydraulic Piston Drive
Useful Links and Sources:

**Electronics Parts sources:**
- http://www.digikey.com -- Commercial first quality parts
- http://www.mouser.com -- Commercial first quality parts
- http://www.allelectronics.com -- Surplus Parts, LEDs, motors
- http://www.surplusgizmos.com -- Surplus parts
- http://www.goldmine-elec-products.com -- Surplus parts
- http://stores.ebay.com/ledbaron -- Wired SMD micro LEDs
- http://www.ngineering.com -- Wire LEDs & tools
- http://stores.ebay.com/tech-fixx -- 38 Gauge Wire Source:

**Arduino parts of all sorts:**
- http://sparkfun.com -- Stuff for sale & reference material
- http://www.adafruit.com -- Stuff for sale & reference material
- http://ebay.com/ -- Lowest cost Pro Mini boards

**Arduino reference material:**
  Clinic Slides from 2011 NMRA Convention in Sacramento, CA

**This Presentation:**
home.comcast.net/~gbglacier/Clinics/Modeling_w_Motion_NMRA2015.pdf

**Clinic Supplemental Materials:**
home.comcast.net/~gbglacier/Clinics/AnimationControl_Clinic_adds.zip
Here are links to some of my animation articles which are all in free online Modeling Magazines:

**Using Micro LEDs on Your Layout**  

**Crossbucks and Crossing Gates**  

**Bring a Wrecking Crane to Life**  
MRH [http://tinyurl.com/mjtwdp4](http://tinyurl.com/mjtwdp4) (Cover Article, Page 53)

**Teach Your Engineers to Turn Heads**  
MRH [http://publ.com/5nm2Wxy#/100](http://publ.com/5nm2Wxy#/100)

**Scale Flash Photography**  

**Scale Model Animation Adding Life to a Layout**  
*Railroad Model Craftsman Magazine, May 2014*

**Battery Powered Models in HO Scale**  

**Starting from Scratch with an Arduino Pro Mini (or Moteino)**  

You can read my Scale Model Animation blog here (Animation & DCC decoders):  

and you can see additional videos on my YouTube channel on animation:  
[http://www.youtube.com/user/DrGeoffB](http://www.youtube.com/user/DrGeoffB)

I hope you enjoy them too!
A Step by Step Cookbook for the Modeler Using the Pro Mini can be found here: Starting from Scratch with an Arduino Pro Mini (or Moteino):

A good start for the Arduino Learning curve would be the tutorials at:
and there are allot of topics there for search for a subject or browse
or
or
http://www.richardvannoy.info/arduino.php
or
http://arduino-info.wikispaces.com/TUTORIALS
Now these offer info at different learning levels so pick one you are comfortable with, or ask a specific question and I will point you in the right direction.
If you are using an Arduino Pro Mini (cheapest full function available) try:

For combining DCC decoder control of Building Lighting animation try:
Scale Model Animation 18: DCC Control for Random Building Lighting
http://model-railroad-hobbyist.com/node/23026
Modeling with Motion Scale Model Animation

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