Model Railroad Makerspaces

Hacker Culture, Model Railroading and How Makerspaces can Help Ease Access to a Versatile Hobby and Diversify its Audience

Why Model Railroading?

- Magic of Miniatures
- Fun of modeling and operation
- Unifies a multitude of sub-hobbies, e.g.,
  - Electronics and computer control
  - Carpentry
  - Modeling / Visual Art
  - Photography and Prototype Studies
- Huge variety of interests, no right or wrong, e.g.
  - Freelance operations with no or abstract scenery
  - Watch running trains through landscape
  - Prototypical modeling/operation, telling a story

Why here?

- One of the origin of „hacking“ and its culture: The MIT **Tech Model Railroad Club** (TMRC)
- Founded in 1946, published TMRC language dictionary in 1959

FOO: the sacred syllable (FOO MANI PADME HUM); to be spoken only when under inspiration to commune with the Deity. Our first obligation is to keep the Foo Counters turning. *Use of this word at TMRC antedates my coming there. A foo counter could simply have randomly flashing lights, or could be a real counter with an obscure input.*

HACK: 1) an article or project without constructive end; 2) aork undertaken on bad self-advice; 3) an entropy booster; 4) to produce, or attempt to produce, a hack.
I saw this as a term for an unconventional or unorthodox application of technology, typically deprecated for engineering reasons. There was no specific suggestion of malicious intent (or of benevolence, either). Indeed, the era of this dictionary saw some "good hacks:" using a room-sized computer to play music, for instance; or, some would say, writing the dictionary itself. ("aork" was just a typo for "work.")

HACKER: one who hacks, or makes them.
A hacker avoids the standard solution. The hack is the basic concept; the hacker is defined in terms of it.

The Tech Model Railroad Club

- „Hack“ originally referred to elaborate MIT campus pranks
- hacker ethic (as of Levy) originated from TMRC
  - „information wants to be free“
  - „access to computers ... should be unlimited and total“
  - „mistrust authority – promote decentralization“
  - "Hackers should be judged by their hacking, not bogus criteria such as degrees, age, race, sex, or position"
  - "You can create art and beauty on a computer"
  - "Computers can change your life for the better"

The Tech Model Railroad Club

- Organized in fractions
  - Modeling and Landscaping *(„Knife-and-Paintbrush“)*
  - Signals and Power Subcommitee (S&P)
    electronics and software
  - Midnight Requisitioning Subcommittee
    “obtained“ parts independently of campus rules

Relevance of Electronics and Software

- Layout controlled by „The System“
  - 1200 relays, incorporating spare telephone system
  - Extended with computer control (TX-0, PDP-1)
  - Also used for non-MRR projects, led to conflicts
- Complexity of large railroad systems
  - Turning hundreds of switches
  - Detecting rolling stock locations
  - Traffic management based on blocks and signals
  - Guaranteeing safety and operation on schedule

Video from 2012: https://www.youtube.com/watch?v=STVdCJaG0bY (few details, unfort.)

TMRC Layout

Photos: Original Layout, 1996

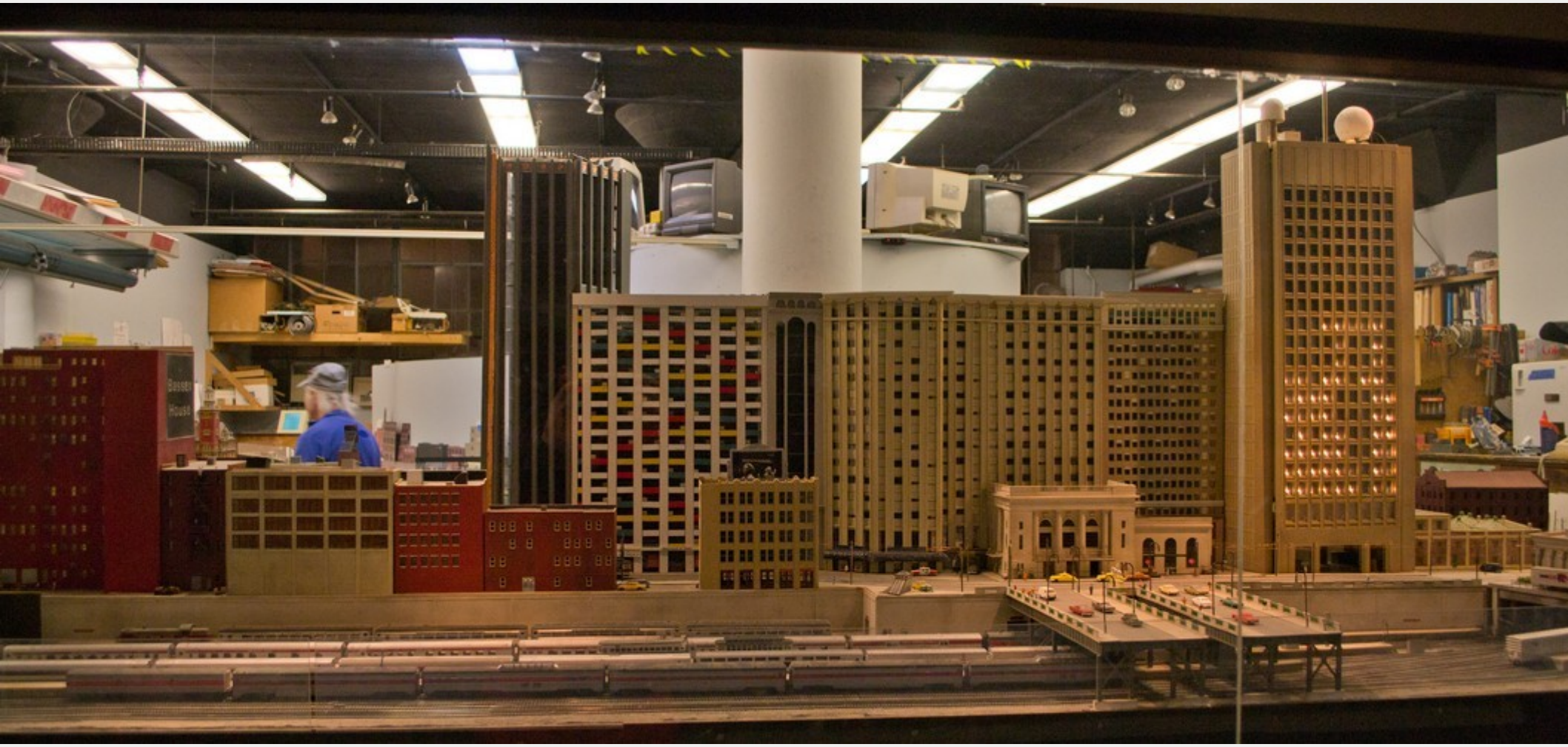
(removed for copyright reasons, Links below)

http://tmrc.mit.edu/history

http://tmrc.mit.edu/rmc/rmc.html

TMRC Hacks

Tetris on MIT Green Building
(new layout after 1999, 2011 on real building)



Josh Graciano (https://commons.wikimedia.org/wiki/File:Tech_Model_Railroad_Green_Building.jpg), „Tech Model Railroad Green Building“, https://creativecommons.org/licenses/by-sa/2.0/legalcode

TMRC Current Layout

- Relatively big layout
  (in terms of US standards
  probably medium size)
- Many opportunities
  for operation
- Typically built by
  several people
  together (club, etc.)
- Requires several
  people to operate
  or a computer system
  and sophisticated
  electronics

http://tmrc.mit.edu//TNP

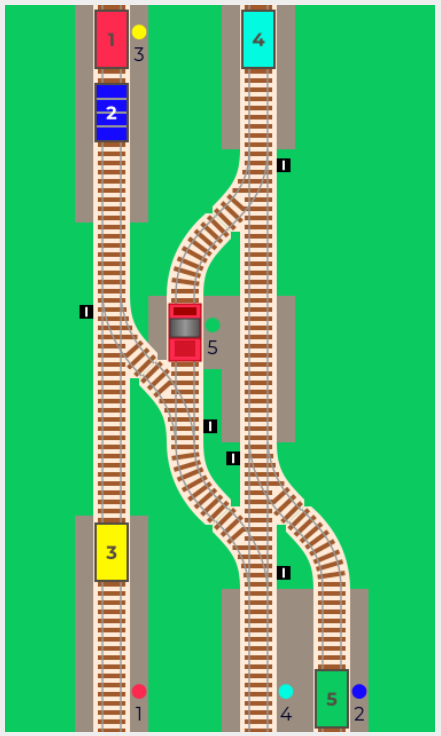
What is operation?

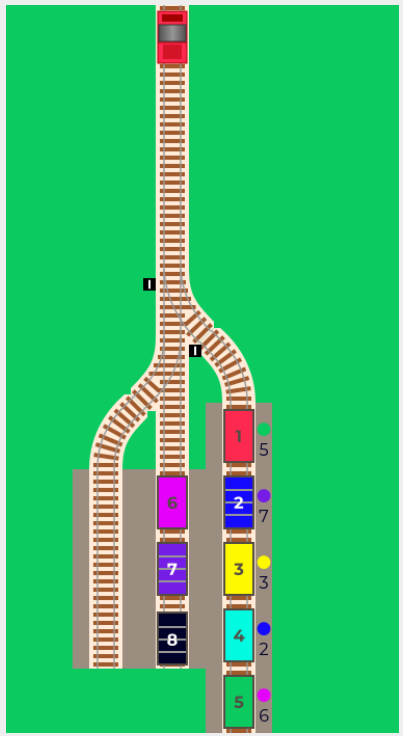
- Considered as primary motivation for many (but by far not all) model railroaders
- Game with many levels of difficulty, many tasks:
  - Driving trains according to a schedule
  - Assembling/Disassembling trains in yards
  - Switching (freight) cars to/from industries
  - Controlling traffic (Operate an interlocking tower)
- Can be formal (with paperwork – warrants, way bills, etc.) or informal tasks assigned to players

US specific perspective: https://www.youtube.com/watch?v=pH0oafZKiDY

Try it yourself

- Switching operations can be stripped down to „shunting puzzles“
- Two puzzles can be discovered in the world: „Inglenook“ and „Timesaver“
  - Requires some thinking
  - Abstract and compressed, but part of the prototype
  - Look for the cellar in Lebkuch.is village
  - Timesaver is hard to reach, but link should be obvious





Exhaustive Reference: http://www.wymann.info/ShuntingPuzzles/

Building a Model Railroad

- Involves several tasks, roughly in order:
  - Planning a layout
  - Building benchwork
  - Laying track
  - Wiring and installing electronics
  - Modelling scenery (ballast, earth, greens, trees, etc.)
  - Modelling structures (stations, buildings, etc.)
  - Controlling and servicing rolling stock
  - Controlling and servicing track and switches

Building a Model Railroad

- Challenges:
  - Capentry requires a lot of skill and a workshop
  - Commercial models are expensive, DIY modelling is cheap but has high entry barrier and may be time consuming
  - Trend towards more details and photorealism while community is declining, lack of diversity
- Our goals:
  - Building (and operating) together in workshops targeting modular layouts and design techniques
  - Extensively use makerspace equipment, templates and new tools to lower barrier
  - Connect to related areas of interest (art, architecture, fantasy games)

Collection of Ideas

- Lasercut leightweight modules
  parametrized design easy to use, only needs to be glued together
- Use N scale (1:160)
  small but capable, modules can serve as a decorative shelf layout even in small apartments or operated in large setups
- Tools for trackwork
  ease tracklaying and wiring with laser cut track forming and cutting fixtures, wiring template, best practice handbook
- Manufacturing process for low cost scenery materials
  e.g., flock from sponge, static grass from hemp ropes, ballast from backyard dust, trees from homegrown sea foam, …

Collection of Ideas

- DIY buildings with lasercutter / plotter
  proven templates for typical buildings in Inkscape, easy customizable, cut from paper/wood/plastic
- DIY surface casting (cobbles, brick, …)
  laser cut surface masters, copied with silicon mould for plaster/polurethane/PVA castings
- 3D printed details / structures / rolling stock
  designing is tedious, but collected designs from skilled modellers can be modified, combined or reused/reprinted easily by everyone
- Arduino and Free Software based electronics
  control your layout with Arduino based DCC++Ex and your smartphone, build DIY electronics based on more Arduinos, automation with JMRI

Modular Model Railroads

Benefits of Modular Railroads

- Build a large layout from several small ones
  - Many people contribute modules to play together
  - Different setups with different participants
- Several module standards known (N scale)
  - Primarily US: N-Trak, T-Trak
  - Germany/Europe: Fremo N-RE, N-club international
- Others
  - H0 Scale, e.g., Nord-Modul, MiniMax
  - Concepts, e.g. TOMA

Module motives: https://www.fremo-net.eu/praxis/module/motive-fuer-module

Playing Together

Call to Action

- Collect interested participants
- Collect ideas, create platform for sharing
- Regular (online) meetings?
- Connect with other makerspaces
- Contact:
  - IRC: #zam-mrc (libera.chat)
  - Wiki: https://wiki.betreiberverein.de/books/projekte-und-ideen/page/rc3-2021-workshop-notes