MUDDL TO MUDDLE

DESIGNING A SCRIPTING LANGUAGE FOR MMOS

6TH DECEMBER, 2017

GAMES HUB

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- I DECIDED TO PUT SOME **SLIDES** TOGETHER FOR THIS TALK SO I'D LOOK **PROFESSIONAL**
  - EVEN THOUGH I'M NOT BEING **PAID** TO SPEAK...
- AS THIS IS BEING ORGANISED BY THE **GAMES HUB** HERE AT ESSEX UNIVERSITY, I THOUGHT I'D TALK ABOUT SOMETHING THAT CAME **OUT** OF THE UNIVERSITY BACK IN THE DAY
- **I** WAS A STUDENT HERE, AND I USED TO RUN THE **COMPUTER SOCIETY**
  - AS SECRETARY AND AS CHAIRMAN

- HERE'S MY MEMBERSHIP CARD FROM 1981/82:

- NOTE: WE CALLED OURSELVES **COMPSOC**, WITH ONLY A **VAGUE** IDEA OF WHETHER THE **COMP** WAS **COMPUTER** OR **COMPUTING**...

- WHEN I ARRIVED AT ESSEX UNIVERSITY IN 1978, THE SECRETARY OF COMPSOC WAS **ROY TRUBSHAW**

- **THIS** IS ROY READING A **MANUAL**
  - THE **BEST** PROGRAMMERS READ MANUALS FOR **FUN**!

- THOSE **MACHINES** BEHIND HIM ARE **TELETYPES**

- HERE ARE THE STATE-OF-THE-ART **FACILITIES** WE HAD BACK THEN:

PRINTOUT BASKET

PUNCHED CARD WRITER

TELETYPE
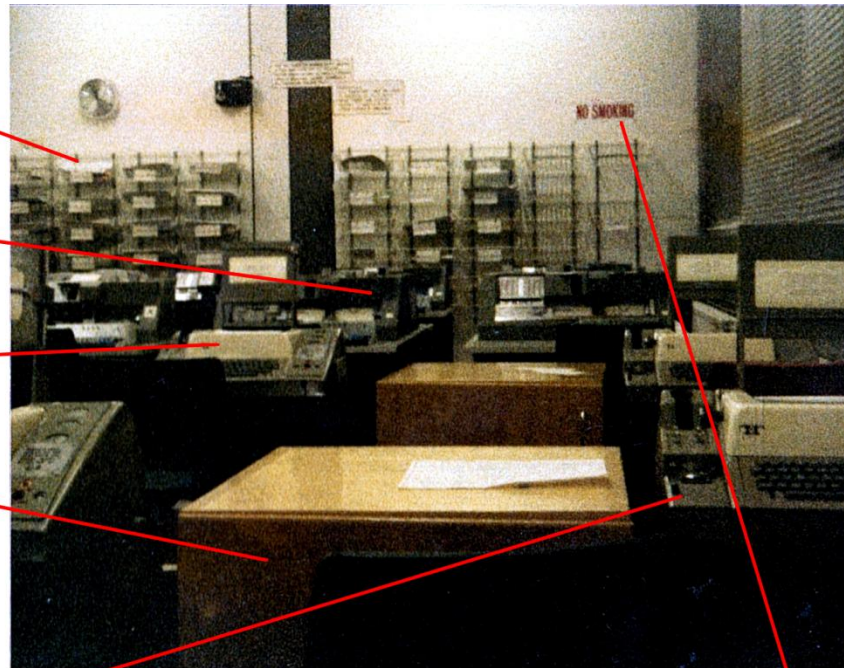
BOXES OF PAPER IN HERE

PAPER TAPE PUNCH/READER

COMPSOC I PASSWORD

- **ALL** OF WHAT IS NOW LAB 1 WAS OCCUPIED BY THE **DECSYSTEM 10** MAINFRAME
  - INCLUDING ITS DISC DRIVES, MAGNETIC TAPE DRIVES, DECTAPE DRIVES, PDP-11 FRONT ENDS, CONSOLE, MORE LINEPRINTERS, PLUS **27** MORE CO_2 CYLINDERS THAN WERE NEEDED TO FLOOD THE ROOM

- THE **DEC-10** (OR **PDP-10**) WAS THE PRIMARY SCIENTIFIC COMPUTER OF ITS ERA
  - **SO** MUCH BETTER THAN THE IBM 360

- IT HAD A **BEAUTIFULLY**-DESIGNED INSTRUCTION SET AND ARCHITECTURE

- **READING** THROUGH THE MANUALS, ROY CAME ACROSS THE IDEA OF **INTER-PROCESS COMMUNICATION**
- **TOPS-10**, THE DEC-10 OPERATING SYSTEM, HAD A WAY TO SEND **BLOCKS** OF INFORMATION BETWEEN PROCESSES
  - 1 BLOCK = 1 **PAGE** = 512 **WORDS**
  - 1 WORD = 36 **BITS**
- HE WANTED TO **PLAY** WITH THIS, BUT IT NEEDED SYSTEM **PRIVILEGES** HE DIDN'T HAVE
  - THE TOTAL NUMBER OF IPC BLOCKS WAS **LIMITED**

- THE DEC-10'S 2^{18} WORDS OF **MEMORY** WAS ORGANISED AS TWO **SEGMENTS**
  - NAMED FOR THE **LEFTMOST** BIT OF AN ADDRESS
- THE **HIGH** SEGMENT WAS **SHARED** AND **WRITE-PROTECTED**
  - USED FOR **CODE**, SO IF 20 PEOPLE WERE USING THE **SAME** EDITOR THERE WOULD ONLY BE **ONE** COPY OF IT IN MEMORY
- THE **LOW** SEGMENT WAS **NON-SHARED** BUT WRITEABLE
  - USED FOR PROCESS-**SPECIFIC** DATA SUCH AS TEXT

- ROY DECIDED TO WRITE HIS **OWN** IPC LIBRARY
- LOOKING THROUGH A **MANUAL** TO FIND SOMETHING THAT LET HIM **DO** IT, HE CAME ACROSS THIS:

```
RESET
setz      1,
setuwp    1,
halt
```

- **SETUWP – SET USER WRITE PROTECT**
  - ALLOWS THE USER TO MAKE THE HIGH SEGMENT WRITEABLE **WHILE REMAINING SHARED**!

- ROY IMMEDIATELY SAW THAT THIS WAS **FAR** MORE POWERFUL THAN WHAT SIMPLE IPC **MESSAGE-PASSING** OFFERED

- YOU COULD USE IT TO SHARE **DATA** AND SHARE **DATA STRUCTURES**
  - YOU DIDN'T NEED TO **PASS** DATA – EVERYTHING WAS ALREADY **THERE**!

- SO, WHAT DID ROY DO TO **TEST** HIS IDEA?

- WELL, HE WROTE A PROGRAM CALLED **MUD**
  - **M**ULTI-**U**SER **D**UNGEON

- THIS WAS CIRCA 20TH OCTOBER, 1978

- THE **D** IN *MUD* WAS FOR **DUNGEON**
- *DUNGEON* (ACTUALLY *DUNGEN*) WAS A **FORTRAN** TRANSLITERATION OF **ZORK**
  - ROY HAD PLAYED THIS AT MIT OVER WHAT WOULD BECOME THE INTERNET
- *ZORK* WAS **MUCH** BETTER THAN *ADVENT* AND *HAUNT*, ITS COMPETITORS, SO ROY THOUGHT THE **GENRE** WOULD BE CALLED **DUNGEONS**
  - IN **THIS** SENSE, *MUD* WAS A MULTI-USER DUNGEON
- UNFORTUNATELY IT **ACTUALLY** CAME TO BE CALLED **ADVENTURES**, AS *ADVENT* WAS FIRST...

- ## THIS IS WHAT *ADVENT* LOOKED LIKE:

```
.RUN ADV11

WELCOME TO ADVENTURE!!  WOULD YOU LIKE INSTRUCTIONS?


YES
SOMEWHERE NEARBY IS COLOSSAL CAVE, WHERE OTHERS HAVE FOUND
FORTUNES IN TREASURE AND GOLD, THOUGH IT IS RUMORED
THAT SOME WHO ENTER ARE NEVER SEEN AGAIN. MAGIC IS SAID
TO WORK IN THE CAVE.  I WILL BE YOUR EYES AND HANDS. DIRECT
ME WITH COMMANDS OF 1 OR 2 WORDS.
(ERRORS, SUGGESTIONS, COMPLAINTS TO CROWTHER)
(IF STUCK TYPE HELP FOR SOME HINTS)


YOU ARE STANDING AT THE END OF A ROAD BEFORE A SMALL BRICK
BUILDING . AROUND YOU IS A FOREST. A SMALL
STREAM FLOWS OUT OF THE BUILDING AND DOWN A GULLY.


GO IN
YOU ARE INSIDE A BUILDING, A WELL HOUSE FOR A LARGE SPRING.


THERE ARE SOME KEYS ON THE GROUND HERE.


THERE IS A SHINY BRASS LAMP NEARBY.
```

- ```
  THERE IS FOOD HERE.


  THERE IS A BOTTLE OF WATER HERE.
  ```

(IMAGE FROM WIKIPEDIA)

- ADVENT, AKA COLOSSAL CAVE, WAS ONE OF THE **VERY** FEW **GAMES** AVAILABLE AT THE TIME
  - WHEN COMPUTERS COST **MILLIONS**, GAMES ARE SEEN AS A **WASTE** OF **RESOURCES**
  - SOMETIMES, ADVENT WAS **REMOVED** SO ESSEX STUDENTS COULDN'T **PLAY** DURING BUSY PERIODS
- STUDENTS COULDN'T ACCESS ADVENT'S **SOURCE** CODE AS THEY MIGHT THEN **COMPILE** IT AND HAVE THEIR **OWN** VERSION
- HOWEVER, ROY SYSTEMATICALLY WENT THROUGH **DECUS** DECTAPES UNTIL HE **FOUND** IT...

- THE WAY TEXT ADVENTURES WORK, PLAYERS TYPE **COMMANDS** WHICH ARE THEN **EXECUTED**
  - COMPUTERS **ALL** HAD COMMAND-LINE INTERFACES BACK THEN, SO THIS WAS WELL **UNDERSTOOD**
- YOU HAVE TO **PARSE** WHAT USERS TYPE SO YOU CAN ASSOCIATE **THEIR** COMMANDS WITH **YOUR** CODE
- YOU'RE BASICALLY LOOKING FOR A **FUNCTION** AND ITS **PARAMETERS**
  - A **VERB** AND THE **NOUNS** TO APPLY IT TO

- *ADVENT* HAD **TWO** FORMATS FOR COMMANDS; ROY ADDED A **THIRD** FOR *MUD:*
  - <VERB>
    - *EG.* QUIT
  - <VERB> <NOUN>
    - *EG.* GET SWORD
  - <VERB> <NOUN> <PREPOSITION> <NOUN>
    - *EG.* OPEN DOOR WITH KEY

- THE PARSER I WOULD LATER WRITE FOR *MUD2* WAS **FAR** MORE *sophisticated,* BUT IT **STILL** REDUCED TO FIND-A-FUNCTION-AND-PARAMETERS

- THE REASON ROY WANTED TO LOOK AT THE CODE FOR *ADVENT* WAS TO FIND OUT WHAT WAS DATA

- **VERSION 1** OF *MUD* WAS JUST A SHARED-MEMORY TEST THAT IT TOOK ABOUT **2 HOURS** TO WRITE

  – THE VOCABULARY AND COMMANDS WERE **HARD-CODED** INTO IT

- ROY STARTED WORK ON **VERSION 2** STRAIGHT AWAY BUT HAD TO **DECIDE** HOW TO ADD WHAT WE'D NOW CALL **CONTENT**

- HARD-CODING IT IN **MACRO-10** WAS TEDIOUS

- HIS SOLUTION WAS A **BOOTSTRAP** APPROACH

- HE WOULD **HARD-CODE** INTO *MUD* A SET OF COMMANDS THAT COULD BE USED TO ADD **NEW** COMMANDS FROM **WITHIN** *MUD* ITSELF

- IF YOU WANTED TO CREATE A **CREATURE**, FOR EXAMPLE, YOU'D RUN *MUD* AND ISSUE A COMMAND SOMETHING LIKE `create ox`
  - IT WOULD ADD THE NEW **OX** OBJECT TO THE DATA STRUCTURES
  - INDEED, THIS IS WHAT **I** DID IN NOVEMBER 1978

- THERE WERE SEVERAL **PROBLEMS** WITH THIS

- 1) IT WAS **MESSY** TO PARSE META-COMMANDS TO ADD NEW PLAYER-COMMANDS

- 2) YOU HAD TO **SAVE** ("DUMP") THE DATABASE PERIODICALLY TO **COMMIT** YOUR WORK, BUT HAD TO DUMP **ALL** OF IT, NOT JUST NEW BITS

  – INCLUDING PLAYER CHARACTERS..!

- 3) PROGRAMMING A GAME THE SIZE OF *MUD* IN AN **ASSEMBLY** LANGUAGE IS A **GRIND**

- IN LATE 1979, ROY DECIDED TO **DISCARD** VERSION 2 AND WRITE **VERSION 3** IN **BCPL**

- HERE'S A **PRINTOUT** OF A 1980 MUD LOG...


```
LOGGING MUD ON 15TH OCTOBER 1980 AT 14:54:22

*SCORE
YOUR SCORE SO FAR IS 0
STRENGTH=51, STAMINA=85, DEXTERITY=37
WEIGHT CARRIED=0 (MAX. WEIGHT=51000G.)
MAXIMUM STAMINA=85
IF YOU QUIT NOW YOUR LEVEL OF EXPERIENCE WOULD BE NOVICE
GAMES PLAYED TO DATE 1

*WIZARD MODE

*SORCERY
WELCOME OH MASTER!

*****S
ROOM PATH
PATH.
YOU ARE STANDING ON A PATH WHICH LEADS OFF A ROAD TO THE NORTH, TO A
COTTAGE SOUTH OF YOU. TO THE WEST AND EAST ARE SEPARATE GARDENS.

*****S
ROOM HALL
HALL.
YOU ARE STANDING IN AN ODDLY SHAPED HALL. TO THE SOUTH IS A DOORWAY,
THE EAST IS AN ARCHWAY AND SOME DARK FORBIDDING STAIRS LEAD UPWARDS
TO THE SOUTHEAST. IMMEDIATELY TO THE WEST IS A FITTED WARDROBE, AND
SOME EERIE, GRANITE STEPS TO THE SOUTHWEST LEAD DOWNWARDS TO THE CELLAR.
THE KITCHEN DOOR IS LOCKED SHUT.
```

- VERSION 3 OF *MUD* BECAME KNOWN AS **MUD1**, TO DISTINGUISH IT FROM THE **GENRE** THAT TOOK ITS NAME

- ROY NOW KNEW THAT ADDING CONTENT TO *MUD* FROM **WITHIN** *MUD* ITSELF WAS A **BAD** IDEA
  - ALTHOUGH THE CONCEPT **WAS** LATER REDISCOVERED AND USED BY *TINYMUD*

- IT WOULD BE **BETTER** TO DESIGN A DEFINITION **LANGUAGE** TO SPECIFY MUD COMMANDS
  - **THIS** IS WHY ROY LOOKED AT *ADVENT*'S CODE — TO SEE HOW *ADVENT* DID IT

- *ADVENT* USED AN INELEGANT **MIXTURE** OF HARD CODE AND SOFT CODE FOR ITS CONTENT

- NEVERTHELESS, ROY BASED SOME OF HIS **OWN** LANGUAGE ON PARTS OF IT
  - PARTICULARLY THE **TRAVEL TABLE**

- HE CALLED HIS LANGUAGE **MUDDL** – THE **MUD D**EFINITION **L**ANGUAGE
  - HE KNEW THE ONE FOR *ZORK* WAS CALLED **MDL**, SO THIS WAS A NOD IN ITS DIRECTION
  - ALSO, ROY HAD BEEN NICKNAMED **TRUBBL** BY THE COMPUTER SERVICE STAFF AT ESSEX...

- THE IDEA WAS THAT YOU WROTE THE **BULK** OF THE GAME IN **MUDDL**, WHICH WAS THEN **COMPILED** INTO **MACRO-10**
  - HE CALLED HIS COMPILER **DBASE**

- YOU **ASSEMBLED** THIS MACRO-10 AND **LOADED** IT INTO THE SHARED HIGH SEGMENT ALONG WITH THE COMPILED **BCPL**

- YOU COULD THEN **RUN** THE GAME AND THE DATA STRUCTURES **REPRESENTING** THE MUDDL WOULD BE ALL SET
  - ASSUMING YOU LINED THE ADDRESSES UP RIGHT

- SO, LET'S **LOOK** AT MUDDL
- A MUDDL PROGRAM WAS DIVIDED INTO SEVERAL **SECTIONS**, EACH WITH ITS OWN **SYNTAX**
- THE **MAIN** SECTIONS WERE:
  - ROOMS
  - VOCABULARY
  - OBJECTS
  - TRAVEL TABLE
  - ACTIONS
  - TEXT
- I LATER ADDED MORE FOR MOBILES, DAEMONS *ETC.*

- ROOMS HAD A **NAME**, SOME PROPERTIES, A SHORT DESCRIPTION AND A LONG DESCRIPTION

- HERE'S THE **START** LOCATION:

```
start     light     startrm
          Narrow road between lands.
          You are stood on a narrow road between The Land and whence you came.
          To the north and south are the small foothills of a pair of majestic
          mountains, with a large wall running round. To the west the road
          continues, where in the distance you can see a thatched cottage opposite
          an ancient cemetery. The way out is to the east, where a shroud of
          mist covers the secret pass by which you entered The Land.
```

- ROOMS COULD **SHARE** LONG AND/OR SHORT DESCRIPTIONS TO SAVE MEMORY

  - EG. `%nhill1` TO USE `nhill1`'S DESCRIPTION

- MUDI HAD ABOUT **400** ROOMS – QUITE BIG!

- THE VOCABULARY SECTION STATED WHAT **WORDS** MUD WOULD ACCEPT
- IT STARTED OFF WITH **CLASSES**
  - THESE WERE **NOT** PROPER CLASSES...
- EVERY OBJECT **HAD** TO HAVE A CLASS, BUT CLASSES **COULDN'T** HAVE SUBCLASSES
  - SO **MOST** CLASSES HAD JUST **ONE** OBJECT
- THE VOCABULARY ALSO LISTED THE **OBJECTS**, BUT INCLUDED SOME **PROPERTIES** FOR THOSE OBJECTS
  - THAT'S **NOT** A VOCABULARY THING!

- HERE'S WHAT THE VOCABULARY ENTRIES FOR OBJECTS **LOOKED** LIKE:

```
chain      links      4000      40
mosaic     chip       10        5
stove      oven       0         0
trophy     triumph    1000      35
throne     chair      60000     200
forge      flame      0         0
poker      prod       3000      20
icicle     ice        1000      0
pot        container  2000      0
```

- OBJECT, CLASS, **WEIGHT** IN GRAMS, **VALUE** IN POINTS

- THE VOCABULARY ALSO HAD A **SYNONYMS** SUBSECTION, WHERE YOU COULD SAY *EG.* THAT `brolly` POINTED AT THE `umbrella` OBJECT

- MUDDL STARTS TO GET **COMPLICATED** WHEN IT COMES TO **OBJECTS**

- OBJECTS IN *MUDI* HAD DIFFERENT **STATES** KNOWN AS **PROPERTIES**

  – THEY ALSO HAD **OTHER**, BINARY PROPERTIES...

- HERE'S A RELATIVELY SIMPLE OBJECT DEFINITION:

```
longsword sea14    1      1       2         bright    nosummon
0        A murderous, blood-stained longsword lies here.
1        Thrust deep into a rock is a murderous longsword!
```

- THE LONGSWORD STARTS IN SEA14, WITH INITIAL PROPERTY 1, MAX PROPERTY 1, VALUE PROPERTY 2 (SO NOT WORTH POINTS), IT GLOWS IN THE DARK AND BLOCKS SUMMON SPELLS

- ## HERE'S THE **BROADSWORD** DEFINITION:

```
broadsword <cove ifrst2 rost> 1          -1          0          bright     nosummon
0          A marvellous broadsword lies shining in front of you!
1          A fearsome broadsword lies in front of you, a marvel to behold!
```

- ## THIS STARTS IN A RANDOM PLACE AND HAS A RANDOM INITIAL STATE, BUT IT'S WORTH POINTS IN **STATE 0**

- ## HERE'S A MOBILE OBJECT (A "**MOBILE**"):

```
dwarf     3          0          6          dwpst1     0          1          0          15
          noget      contains   15000      transparent           opened     disguised
0          A stocky dwarf eyes you up and down with suspicion.
1          A dwarf sleeps here.
```

- ## **GAWD** KNOWS WHAT THOSE EXTRA NUMBERS MEAN...

- ## THE TRAVEL TABLE HANDLES **MOVEMENT** COMMANDS:

```
nfrst4      n          nfrst1      e          o
            n          clffst      swamp      sw
            n          wfrst1      s
            n          nfrst3      se
            beast      474         jump
            wood       0           jump
            ~parachute             beach      jump
            -13        jump
            n          fslop1      ne
            n          fslop3      n
            51         nw
            52         w
```

- ## THE FIRST COLUMN CONTAINS **CONDITIONS**

  - NONE, "IF YOU'RE CARRYING ONE OF THESE", "IF YOU'RE NOT CARRYING ONE OF THESE", A MESSAGE-PLUS-MOVE, A MESSAGE-BUT-NO-MOVE

- ## THE SECOND COLUMN IS WHERE YOU **GO**

- ## THE REST ARE THE **DIRECTIONS** THIS LINE IS FOR

- ACTION DEFINITIONS ARE THE MOST **COMPLICATED** COMPONENTS OF MUDDL:

```
get        .get      killer    none      ifprop    null    0    0
get        killer    none      unlesslevel         null    5    1049
get        .get      killer    none      set       null    0    1021
```

- SO, `killer` IS THE CLASS FOR `longsword`...

- THE BASIC **FORMAT** IS: VERB SUBJECT OBJECT CONDITION PARAMETER TRUE FALSE
  - THE `.get` IS THE HARD-WIRED GET FUNCTION

- TRANSLATION (ALL THESE ARE FOR `get longsword`):
  - IF THE LONGSWORD IS IN PROPERTY 0, JUST PICK IT UP
  - OTHERWISE, IF YOU'RE NOT LEVEL 5 PRINT MESSAGE 1049
  - OTHERWISE, SET ITS PROPERTY TO 0, PRINT MESSAGE 1021 AND THEN PICK IT UP

- TO FIND OUT WHAT A MESSAGE WAS IN **ENGLISH**, YOU LOOKED AT THE TEXT SECTION:

```
1049       You manage to budge the sword a little way, but you're not experienced
           enough to dislodge it yet. Maybe if you made it to superhero or
           superheroine you'd be able to?
```

- AS YOU CAN SEE, THESE MESSAGES ARE **FIXED**, NOT **DYNAMIC**

  – MUDDL COULDN'T LOOK AT YOUR GENDER ON THE FLY AND DECIDE WHETHER TO USE SUPERHERO OR SUPERHEROINE AS APPROPRIATE

- YES, THAT NUMBER IS **CORRECT**, AND THERE WERE OVER **1,100** SUCH COMMAND RESPONSES IN *MUDI*

- ALTHOUGH MUDDL WAS **POWERFUL**, IT WASN'T POWERFUL **ENOUGH**

- THE ACTION FORMAT DIDN'T ALLOW FOR **LOOPS** OR MULTIPLE **TESTS**

- THE **SPECIAL** COMMANDS SUCH AS **.GET** HAD TO BE HARD-CODED IN, WHICH PUT PRESSURE ON THE **MEMORY** AVAILABLE FOR **OTHER** CODE
  - AND UNDERMINED THE **POINT** OF HAVING A DEFINITION LANGUAGE IN THE FIRST PLACE

- WE HAD 99 SPECIAL FUNCTIONS BY THE END OF MUD1, BUT THAT'S NOT WHAT LED TO MUD2...

- ## THIS IS WHAT FINALLY DID FOR MUDDL:

```
feed       nanny      pan        null       null       681        0
feed       nanny      victuals   destroy    second     682        0
feed       nanny      antidote   destroy    second     682        0
feed       nanny      flower     destroy    second     682        0
feed       nanny      fungus     destroydestroy        toadstool 683        0
feed       nanny      limb       null       null       684        0
feed       nanny      corpse     null       null       684        0
feed       nanny      sprig      destroydestroy        mistletoe 685        0
feed       nanny      frog       null       null       684        0
feed       nanny      bird       null       null       684        0
feed       nanny      birdofprey            null       null       684        0
feed       nanny      rodents    null       null       684        0
feed       nanny      bunny      null       null       684        0
feed       nanny      vermin     null       null       684        0
feed       nanny      familiar   null       null       684        0
feed       nanny      herring    destroy    second     682        0
feed       nanny      serpent    null       null       684        0
feed       nanny      nut        destroy    second     682        0
feed       nanny      pen        destroy    second     682        0
feed       nanny      parachute destroy    second     682        0
feed       nanny      money      destroy    second     682        0
feed       nanny      gem        destroy    second     682        0
feed       nanny      liquid     destroy    second     682        0
feed       nanny      rum        null       null       930        0
feed       nanny      medication            destroy    second     682        0
feed       nanny      paper      destroy    second     682        0
feed       nanny      map        destroy    second     682        0
feed       nanny      tome       destroy    second     682        0
feed       nanny      adventurer            null       null       1094       0
feed       nanny      book       destroy    second     682        0
```

- IN ORDER TO **ESCAPE** THIS LIMITATION, I DECIDED TO REWRITE *MUD* FROM **SCRATCH**
  - **VERSION 4**, WHICH BECAME KNOWN AS *MUD2*
- AT THE **CORE** OF IT WOULD HAVE TO BE A NEW **DEFINITION** LANGUAGE
  - WHICH I CALLED **MUDDLE**
  - **M**ULTI-**U**SER **D**UNGEON **D**EFINITION **L**ANGUAGE
- I HAVE **TWO** EXERCISE BOOKS FULL OF **NOTES** ON THE DESIGN OF MUDDLE
- IT'S A FULLY-FLEDGED PROGRAMMING LANGUAGE
  - YOU COULD WRITE A MUDDLE COMPILER IN MUDDLE

- MUDDLE SEPARATED THE **VOCABULARY** FROM THE **PROGRAMMING** OBJECTS:

```
$[      eye
        noun::  ruby1
        verb:   eye
$]
```

- THIS SAYS THAT THERE'S A **WORD**, `eye`, WHICH WHEN IT'S USED AS A **NOUN** REFERS TO THE **ATOM** `ruby1` AND WHEN IT'S A **VERB** REFERS TO THE ATOM `eye`
  - THE `::` MEANS IT'S A ONE-WAY LINK, SO `ruby1` DOESN'T KNOW THAT `eye` IS A SYNONYM FOR IT

- I'M NOT GOING TO DESCRIBE *MUD2'S* PARSING IN **DETAIL**, BUT IT WAS VERY **STRONG**
  - `pick up all the gems except the green one and put them in the smallest box`
- THE (HARD-WIRED) PARSER GAVE THE MUDDLE **INTERPRETER** A SERIES OF COMMANDS
- COMMANDS WERE **LISTS** OF 1, 2 OR 3 ATOMS
  - OR STRINGS, FOR *EG.* `tell` COMMANDS
- THESE LISTS OF ATOMS WERE PATTERN-MATCHED AGAINST **DEFINITIONS** WRITTEN IN MUDDLE
- **THIS** IS WHERE IT GETS INTERESTING...

- MUDDLE CODE IS ASSOCIATED WITH **PATTERNS**:

```
{ get longsword }:
{ get longsword room }:
{ get longsword loosener }:
{ get longsword creature }:
{ get longsword container }:
```

- THESE ARE THE **FUNCTION** AND **PARAMETERS** THAT COME FROM COMMANDS

- **IMPORTANT**: THOSE ATOMS THERE REPRESENT **CLASSES**

  - `{ get longsword room }`: MEANS GET ANY OBJECT OF TYPE `longsword` FROM ANY OBJECT OF TYPE `room`

- **INSIGHT**: THE ATOMS **ARE** THE CLASSES

- IN A LANGUAGE SUCH AS C++ OR JAVA, CLASSES ARE **TEMPLATES** FOR **STAMPING** OUT OBJECT **INSTANCES**

- IN MUDDLE, OBJECTS **AND** CLASSES ARE JUST **ATOMS**
  - AN OBJECT IS MERELY AN ATOM WITH NO CHILDREN

- YOU COULD, IF YOU LIKED, HOLD THE **CONCEPT** OF A LONGSWORD, RATHER THAN A PARTICULAR LONGSWORD
  - ALTHOUGH IT WAS MAINLY USED FOR COMMANDS SUCH AS `enumerate treasure`

- ## FURTHERMORE, MUDDLE CLASSES CAN HAVE MULTIPLE PARENTS

```
longsword:
*+          [sword, undamageable]
            desc:
                    loose(first) ->>
                                "A murderous longsword glints ahead of you. ",
                                "Thrust deep into a rock is a murderous longsword! "
            strength: muser(outside(first) 'o') | spellproof(o) ->> 30, 60
            loose: \\
            prop: \\
            luminescent: //
+*
```

- ## HERE, THE `longsword` IS BOTH `sword` AND `undamageable`

- ## SWORD IS ITSELF `metal`, `weapon`, `treasure` AND `loosener`

- WHEN YOU MATCH A **COMMAND** TO A **PATTERN**, YOU MATCH THE MOST LEFT-TO-RIGHT **SPECIFIC**

- ROOMS AND CREATURES ARE BOTH CONTAINERS, SO THE `room` AND `creature` CLASSES ARE **MORE** SPECIFIC THAN THE `container` CLASS

  - **`get ls f here`** WILL MATCH `{ get longsword room }` BEFORE `{ get longsword container }`

  - **`get ls from box`** WILL MATCH `{ get longsword container }`

- MUD2'S OBJECT HIERARCHY WAS SOMETHING LIKE **14** LEVELS DEEP AND HAD **THOUSANDS** OF ATOMS IN IT
- **SOME** ATOMS HAD **50+** CHILDREN
  - TRANSLATION: SOME CLASSES HAD 50+ SUBCLASSES
- YOU MIGHT THINK THIS WOULD BE A HORRIBLE **TANGLE** YOU COULD **NEVER** KEEP TRACK OF
- YOU'D BE RIGHT — IT WAS!
- HOWEVER, YOU DIDN'T **NEED** TO UNDERSTAND IT
- IT HANDLED THE TANGLED MESS **FOR** YOU

- # THE CODE ASSOCIATED WITH PATTERNS **LOOKS** LIKE NORMAL CODE:

```
{ get longsword room }:
(second=outside(me) | checkwiz()) &
$(        the%(first) 'df'
          loose(first) ->> get%(first, second),
          muser(me) ->>
                    !! ("You can't seem to dislodge " + df + ", it won't budge.*N"),
          prop(first) ->>
          $(        checkcanhold(first)
                    loose(first):= //
                    !! ("You easily withdraw " + df + " from the rock.*N")
                    get%(first, second)
          $),
          $(        !! ("You take hold of " + df + " but its magical powers have*
faded, and it disintegrates in your hand.*N")
                    destroy%(first)
          $)
$)
```

- # ALL THE FUNCTION CALLS IN THERE **ALSO** USE THE PATTERN-MATCHING SYSTEM

- MUDDLE IS A **VERY** EASY LANGUAGE TO PROGRAM IN

  - YOU CAN PROGRAM CREATIVELY

- THERE'S EVEN A MUDDLE-TO-C **COMPILER**!

- UNFORTUNATELY, IT'S SO **BOUND UP** WITH THE *MUD2* RUN-TIME SYSTEM THAT YOU CAN **ONLY** USE IT TO WRITE TEXT MUDS

  - IT CAN'T BE COMPILED-AND-LINKED IN **PIECES**

- IT'S ALSO GOT SOME **CRUFTY** BITS I ADDED ON LATER THAT LOOK AN AWFUL LOT LIKE **FEATURE CREEP**..

- I'VE DESIGNED A GENERAL PURPOSE LANGUAGE TO REPLACE MUDDLE THAT I CALL `Clear`

- IT'S **VERY** CUT DOWN
  - IT DOESN'T EVEN HAVE **INTEGERS** BUILT-IN!

- I STARTED WRITING AN **INTERPRETER** A COUPLE OF YEARS AGO, BUT GOT BOGGED DOWN DOING ITS **MACRO**-PROCESSING
  - PLUS THERE ARE TOO MANY **GAMES** I WANT TO PLAY

- **ONE** DAY MAYBE

- PLAYING WITH COMPUTER GAME DESIGN FOR FUN CAN BE **MORE** THAN JUST FUN

  - A **MULTI-BILLION** POUND/DOLLAR/EURO/YUAN **INDUSTRY** CAME OUT OF ROY'S AND MY FUN!

- **COMPUTERS** TODAY ARE **NOT** AS THEY ONCE WERE, BUT **CREATIVITY** IS

- IF YOU **WANT** TO CODE SOMETHING FOR **FUN**, **CODE** IT FOR FUN!

- THEN, **35 YEARS** FROM NOW, IT COULD BE **YOU** HERE BORING GAMES HUB MEMBERS ABOUT "COMPUTERS THE SIZE OF **SHOE BOXES**"!