CLASSIFICATION OF MECHANICAL PUZZLES
&
PHYSICAL OBJECTS RELATED TO PUZZLES.

by James Dalgety & Edward Hordern

BACKGROUND: Several attempts have been made to classify puzzles, but most attempts so far have either been far too specialized in application, or they have been too general to provide the basis for a definitive classification. Many people have provided a great deal of help but particular thanks are due to Stanley Isaacs, David Singmaster, and Jerry Slocum.

OBJECTIVE: To provide a logical and easy to use classification to enable non-experts to find single and related puzzles in a large collection of objects, and patents, books, etcetera related to such objects. (As presented at this stage, whilst examples are given for most groups, some knowledge of the subject is required.)

DEFINITIONS:

A PUZZLE IS A PROBLEM HAVING ONE OR MORE SPECIFIC OBJECTIVES, CONTRIVED FOR THE PRINCIPLE PURPOSE OF EXERCISING ONES INGENUITY AND/OR PATIENCE.

A MECHANICAL PUZZLE IS A PHYSICAL OBJECT COMPRISING ONE OR MORE PARTS WHICH FALLS WITHIN THE ABOVE DEFINITION.

METHOD: A puzzle should be classified by the problem that its designer intended the solver to encounter whilst attempting to solve it. In the case of a 3D interlocking assembly in the form of a cage with a ball in the centre: the fact that the instructions request the would-be solver to "remove the ball" does not change the 3D assembly into an opening puzzle. The disassembly and/or reassembly of the cage remains the primary function of the puzzle. An interlocking puzzle should be classified according to its interior construction, rather than its outward appearance (e.g. a wooden cube, sphere, barrel, or teddy bear may all have similar Cartesian internal construction and so should all be classed as Interlocking-Cartesian). In cases where it seems possible to place a puzzle in more than one category, it must be classified in whichever is the most significant category. A few puzzles may have to be cross-referenced if it is absolutely necessary; however in most puzzles, which include two different classes of problem, one class will usually be dominant by virtue of the fact that in solving it, the secondary problem has also been solved.

A good example of multiple-class puzzles is the "Mazy Ball Game" made in Taiwan in the 1990s - It is based on a 3x3 sliding block puzzle under a clear plastic top - The pieces have L-shaped groves and a ball must be rolled up a ramp in the lower right onto one of the blocks - the ball must be moved from block to block and the blocks themselves slid around so that the ball can exit at the top left. Thus the puzzle requires Dexterity, Sequential movement and Routefinding. It would be classed as Routefinding because, if the route has been found, then the dexterity and sequence must have also been achieved.

A puzzle will be referred to as 2D if its third dimension is irrelevant (e.g. thickness of paper or plywood or an operation involving a third dimension such as folding). Most standard jigsaws are 2D; however jigsaws with sloping cuts in fact have a relevant third dimension, so they must be classed as 3D.

It will be noted that the definition of "A Puzzle" excludes the infants "posting box" which whilst perhaps puzzling the infant was contrived only to educate and amuse; it also excludes the archer attempting to get a bulls-eye, the exercise of whose ingenuity is entirely incidental to the original warlike intent of the sport. Also excluded are puzzles that only require paper and pencil (e.g. crossword puzzles), unless they are on or part of some physical object. It is understood that specialist collectors will further subdivide the Sub-Classes to suit their own specialised needs. For example, Tanglement Rigid & Tanglement Semi-Rigid is awaiting a thorough study of the topology of wire puzzles.

The full abbreviations consist of 3 characters, hyphen, plus up to 4 characters, such as "INT-CART". These are the standard abbreviations for the classes that have been chosen for relative ease of memory and conformity with most computer databases.

The 14 MAIN CLASSES ARE AS FOLLOWS:-

DEXTERITY PUZZLES (DEX) require the use of manual dexterity or other physical skills in their solution.

ROUTEFINDING PUZZLES (RTF) require the solver to find either any path, or a specific path as defined by certain rules.

TANGLEMENT PUZZLES (TNG) have parts that must be linked or unlinked. The linked parts, which may be flexible, have significant freedom of movement in relation to each other, unlike the parts of an interlocking puzzle.

OPENING PUZZLES (OPN) are puzzles in which the principle object is to open it, close it, undo it, remove something from it, or otherwise get it to work. They usually comprise a single object or associated parts such as a box with its lid, a padlock and its hasp, or a nut & bolt. The mechanism of the puzzle is not usually apparent, nor do they involve general assembly or disassembly of parts that interlock in 3D.

INTERLOCKING PUZZLES (INT) interlock in three dimensions, i.e. one or more pieces hold the rest together, or the pieces are mutually self-sustaining. Many clip-together puzzles are "non-interlocking".

JIGSAW PUZZLES (JIG) are made as if cut or stamped into pieces from a single complete object, and the principle objective is to restore them to their unique original form.

ASSEMBLY PUZZLES (NON-INTERLOCKING) **(ASS)** require the arrangement of separate pieces to make specific shapes without regard to the sequence of that placing, they may clip together but do not interlock in 3D. Some have a container and are posed as packing problems.

PATTERN PUZZLES (PAT) require the placing or arrangement of separate pieces of a similar nature to complete surface patterns according to defined rules. The pattern required may be the matching of edges of squares, faces of cubes, etc. The pattern may be colour, texture, shape, etc. Where the pattern is due to differences in shape they must be sufficiently minor not to obscure the similarity of the pieces.

FOLDING & HINGED PUZZLES (FOL) have parts that are joined together and usually do not come apart. They are solved by hinging, flexing, or folding.

SEQUENTIAL MOVEMENT PUZZLES (SEQ) are those that can be solved only by moves which can be seen to be dependant on previously made moves.

JUGS & VESSELS (JUG) have a mechanical puzzle or trick in their construction that affects the filling, pouring or drinking therefrom.

OTHER TYPES OF MECHANICAL PUZZLES & OBJECTS. (OTH) This group is for puzzle objects that do not easily fall into the above categories and cannot be categorised into sufficiently large groups to warrant their own major class. Included in this group are **Balancing, Measuring, Cutting, Math, Logic, Trick, Mystery, & Theoretical puzzles**. Also provision is made for puzzles pending classification.

AMBIGUOUS PICTURES & PUZZLING OBJECTS (AMB) in which something appears impossible or ambiguous.

NON-PUZZLE but related EPHEMERA (EPH) has been included as most puzzle collections include related ephemera which, whilst not strictly puzzles, need to be classified as part of the collection.

Changes to Puzzle Classification 1999.

Prior to 1999 there were separate classes for different dimensions etcetera, which resulted in an unwieldy list.
The number of classes has been reduced by requiring that the Dimensions and the Number of pieces are always stated where relevant. Greater precision has been introduced by allowing a number of Keywords to be entered as Qualifiers.

Counting Pieces: The Number of pieces is stated then a "+", then any special containers or boxes that are relevant to the puzzle. Optionally "in" box or tray may be added if this is not significant to the solution.

Dimensions may be 2D, 3D, 2D&3D, 2Don3D, 2Dto3D, and 4D.

Qualifiers are keywords used to describe the pieces and other important features of the puzzle. Several of these

may be used such as "Magnetic Triangles". Other keywords may be introduced from time to time; but the list should not be allowed to get confusingly long. Typical Qualifiers are: -

- • Rod (A standard Burr has "Square Rods")
- • Polycubes
- • Squashed (A Cartesian burr may be distorted by compression along one straight line)
- • Skewed (A Cartesian Burr may have all its pieces rotated along their length)
- • Diagonal (A Cartesian Burr with the pieces rotated by 45 degrees)
- • Regular
- • Organic
- • Linked
- • Magnetic
- • Powered (Clockwork, Battery, Mains Electric, etc.)

THE TABLE OF CLASS DETAILS FOLLOWS.

PUZZLE CLASS ABBREVIATIONS (PZCODE) are standardized to maximum of 8 characters: XXX-YYYY where XXX is the main class and YYYY is the sub- class.

EXAMPLES of puzzles in each class are given in the right-hand column.

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If there are any updates they may be found at http://puzzlemuseum.com.

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