

1936 Computer Game: Spotlight Golf

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Abstract

This is a *functional* description operation of a ‘Spotlight Golf Machine’ (SGM) in Tasmania. The SGM is an interesting digital product delivering an indoor game simulating golf. The machine examined, No 489, was manufactured in 1936, and allegedly the last machine was produced in 1939 at the start of WWII. As such the SGM predates *all* digital computers, and is almost entirely digital in construction. The description in this paper is derived from discussion with a group of people representing the owners, several careful personal inspections and photography of the machine, accompanied by analysis and study of the extant records. The documentation describes the technology and the state of the art before the allegedly ‘first’ computer was produced.

The present document also serves as an interim *instruction manual* for the machine, as the owners have so far been unable to acquire a copy of the original instruction book. They have however an ‘Abridged Instructions’ card which has been analysed and reproduced.

An *operational* description with details of how it operates is being prepared as a follow-up technical paper. This should be interesting to students of early digital technology and computers.

Background

It should be unnecessary to describe the game of golf. In the 1930s, it was widely played in English-speaking countries. Newspaper reports of Spotlight Golf machines in Great Britain, Canada, Australia, New Zealand, Singapore and the USA have been found; British territories in Africa and India are missing but it would be surprising if machines were not available there too. In the present, golf is played even more widely, especially in Asia. It supports a thriving industry of courses, equipment, books, spectators, and indoor training apparatus.

The *Spotlight Golf Machine* (SGM) was manufactured by the *Spotlight Golf Co. Ltd.* in the UK allegedly until 1939. The start date is dubious until evidence can be found. The name is derived from the display technology: a spot of light representing a ball is focused on the back of a translucent display scroll and visible through it. The Tasmanian machine lists the manufacturer’s address as Triumph House, 185/189 Regent Street, London W. The Tasmanian machine is also dated ‘2/9/36’ (probably 2 September 1936, but could be 9 February) pencilled on the inside of the Floor Unit, and also identified by a small white plate in the Display Unit as Model No 75, Serial No D489.

The Tasmanian machine (Figure 1) is owned by the *Australasian Golf Museum* in Bothwell, Tasmania, Australia [1], a subsidiary of the *Tasmanian Museum and Art Gallery*. It was acquired from New Zealand, is being evaluated and restored on the Museum’s behalf, and I was asked to assess its place in the development of digital computers. A press clipping [4] suggests that it was originally sold in the UK for 62 Guineas, with present value about \$AU 7300.00. (Guineas were reserved for upper-

class products, being 1 Guinea = £1 1s 0d.) The Australian asking price (Mick Simmons Ltd in Sydney) at the same time was £82.



Figure 1 – The Tasmanian machine, in workshop with restorer Craig Ferguson

An SGM was demonstrated in 1936 by Charles Whitworth and Alfred Padgett at the Savoy Hotel in London, and in many places in Australia [3,5,6], as well as elsewhere. A minimum room size of 16 x 12 ft is mentioned at many places, sometimes with a ceiling height of 10 ft (3 m), higher than many modern ceilings. The long direction of 16 ft is needed for the driving direction, while 12 ft wide is needed for the 'putting mat' and the display unit. The machine supports one- and two-player golf game simulation, and is reported as covering many UK golf courses, including St Andrews, Stoke Poges, Sunningdale, Hoylake, Sandwich, and others. The scrolls with the Tasmanian machine are simply printed 'Course No 1' and have not been identified as a real course.

I was surprised on first sighting the machine, as I had expected analogue technology with vacuum tubes and operational amplifiers, but the machine is almost totally digital, using mechanical and electromechanical components. There are only two basic analogue components: one game input, and one display output. The SGM has several memory components, and logic functions. As a computer, it performs transduction, display, logic and memory functions. Its memory capacity is about 1 to 2 bytes. Deducing the mode of operation of the SGM from its construction has been intensely interesting.

Significance

The significance of the SGM is:

- It is a very early digital game of considerable sophistication, perhaps the earliest extant computer-based game.
- Its simulation of golf is extraordinary for the date.
- The SGM predates every electronic computer, and since it contains game controls, memory, logic processing, a visual display, and can be programmed for different courses and holes via slots in the display background or scroll, it has a claim to be a very early computer, perhaps the world's first, albeit specialized and limited.
- Unlike Babbage's Analytic Engine, this machine worked and indeed was in production and exported. The evidence of the serial number suggests that at least 489 machines were made, and probably more until production ceased in 1939.
- The engineering of the unit shows clear evidence of maximizing off-the-shelf technology where possible, with custom parts where essential. I assess the engineering and production quality as good to excellent.
- The SGM has seven bits of information flowing from its game controller to the display unit. It has a writeable memory of about three bits (mechanical) and three bits (electrical). The slots on the scroll provide four bits of data per player's ball position, and can be thought of as a golf hole description or player customization program in ROM. The display contains two movable lights on the scroll corresponding to two balls, and three programmed indicator lights.

Construction and layout

The SGM consists of two key units (items 1,2 listed below), three passive units (3-5), and two replaceable or consumable items (6-7). Figure 2 shows the general layout of most of the items, from an Australian advertisement. Note the display unit and the floor unit; the player 1 light is on.

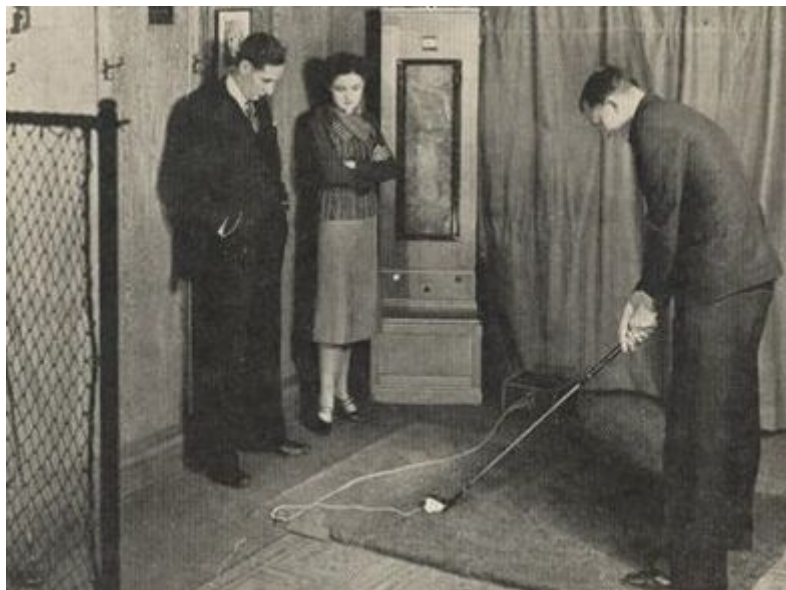


Figure 2 – Photograph from Mick Simmonds Ltd. advertisement, Sydney, Australia [2]

1. The **Floor Unit** is an extremely robust unit which senses the ball's movement immediately after a stroke, and transmits digital signals back to the Display Unit. Electrically, the Floor Unit contains transducers that close or open contacts. There are no logic components and it could be described as a transducer module, but an absolutely critical one vital to the machine's success. (The manufacturer refers to this unit as the 'Floor Motor'. In modern terms it is the game controller.) The unit has a cable connecting it to the Display Unit. There are 14 active wires in the cable. The connectors have 14 peripheral pins in a circle and another which may just serve to locate the plug in its socket, or may be electrically connective.
2. The **Display Unit**. This is about the size and shape of a grandfather clock (72" high, with footprint 20" wide and 13½" deep. The central compartment is 7¼" wide x 7" deep. It sits alongside the playing mat. It contains the SGM's main processing component. The case is constructed of solid English Oak (*Quercus robur*) except for cheaper softwood on the back, and has two user-accessible front doors, the upper of which has a glass panel to view the scroll and spotlights..
3. The **Playing Mat** on which the player stands, and from which the ball is hit. The surface is described as artificial turf.
4. The **Safety Net** towards which the ball is hit, with an aiming mark simulating a flag in the hole. It also serves to anchor a tethered ball so it does not hit the wall or ceilings.
5. A **Putting Mat**, which provides the final stage of putting the ball into the hole on the green. Some machines had a contact in the hole to sense if there is a ball, and a two-wire cable to convey the data to the display unit, but the Tasmanian machine has nowhere to connect such a cable. The surface is described as artificial turf. This component is not visible in the photograph.
6. **Course Scrolls** which describe particular holes, visually and digitally, and are mounted in the Display Unit. The Tasmanian machine has six scrolls, being triplicate copies of the same course (each scroll describes 9 holes or half a course). The scrolls seem to be paper attached to a flexible fabric backing, and are 13½" wide. The edge plates are 3¼" diameter plated steel with a softwood central core. The surviving scrolls are very brittle and in some cases broken or fragile. The material is translucent to allow the 'spotlight' to be visible.
7. **Captive Golf Balls** with strings attached, provided in cardboard boxes. The Tasmanian machine has a box of six, with one missing from the box. If that is the one on the Floor Unit in almost new condition, then it seems this machine had relatively little use before it was retired, consistent with the minor wear on the machine. It may have been unsold merchant stock, supported by triplicate copies of the same course, as these might have been spare parts or stock. A box is not in the photograph, though one ball is.

The game supports two-player games, or a single player. The players or the owner must provide a set or sets of golf clubs, and one normal golf ball for putting. Players keep their own scorecards.

At least one other machine has survived, documented from a Christies' auction in the UK in 2005, though it appears to be less complete than the Tasmanian machine. There may be more.

The Tasmanian machine is sufficiently well-preserved that I consider that it can be restored to working order, even after 77 years. The few missing or degraded components can be replaced by modern components or wiring. Figure 3 shows the interior of the floor unit.

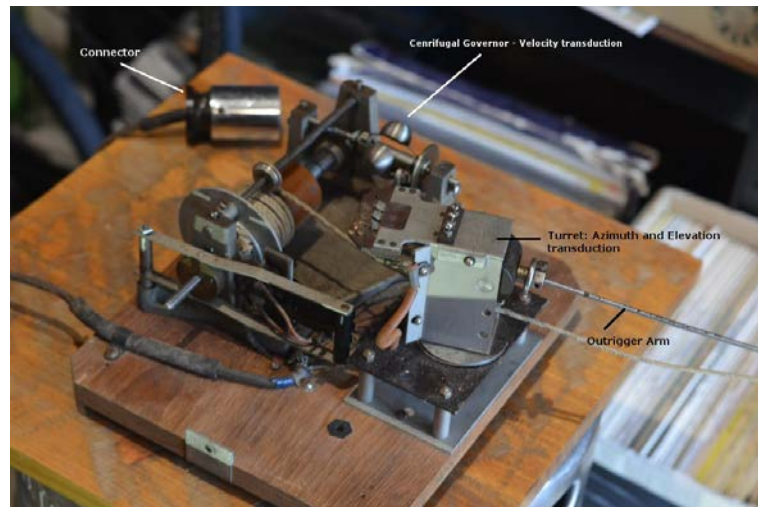


Figure 3 – Floor unit (game controller) with protective carapace removed

Documentation

The available documentation is minimal. The Museum has a somewhat degraded ‘ABRIDGED INSTRUCTIONS’, being a 6” x 4” two-sided card (shown as Figure 4), now re-created on modern card (Appendix 1).

Research has revealed additional documentation has survived, including a UK auction record of a set of manuals in 2006, as well as over 20 newspaper clippings and advertisements, etc. Access to an *Instruction Book* is being pursued, though this document serves as a modern version.



Figure 4 - Obverse and Reverse of surviving *Abridged Instructions* card (modern version in Appendix 1)

Instructions for operation

The front door should be opened. This reveals two travellers (one per player) which can move vertically on rods (see Figure 1). The two sensor covers on the travellers should also be opened. A course scroll should then be fitted to the top of the machine by pulling the crank handle on the right outwards and returning it through the new roller, the scroll slightly unrolled and its end tab inserted in the lower fixed roller and tensioned through the lower crank handle. The two covers that enable sensing on the travellers should then be closed. The scroll is positioned by means of upper and lower manual cranks on the right side of the display unit to show the first hole of the selected course. The two travellers in the display unit are wound down to a base position alongside the starting tee. The front glass door is closed.

The captive ball is positioned on the playing surface, with one string attached to the floor unit and the other to the bottom of the safety net, slack in the strings, exactly in line between the floor unit and the target flag, as shown in the diagram, as described in the *Abridged Instructions*.

The SGM is then powered up by a battery or rectified dc mains power supply in the base of the display unit, and switched on (ON/OFF switch on the lower left side). A light for Player 1 (green) appears in the front panel of the display unit, to indicate that Player 1 should play the first stroke. A focussed spot of light (the eponymous *spotlight*) also appears through the scroll, focussed on the back, to show the position of his or her ball on the tee. Gender neutrality will be omitted hereafter for brevity.

Player 1 selects a driver from his set of clubs, positions himself on the playing surface, and drives the ball, aiming at the target 'flag' on the safety net.

The ball is restrained by its tether, and the floor unit digitally registers the flight direction of the struck ball in azimuth and altitude. The unit also registers the velocity of the struck ball. This data is digitally transmitted to the display unit through a 15-pin plug, cable and socket.

The display unit releases its brake on the player's traveller, mounted on vertical shafts with a counterweight gravity motor, and the traveller moves up in the case to display the predicted landing position of the ball on the scroll. The travellers monitor each other's relative position and change lights and power to player 2 (red).

Player 2 now repeats the process.

In essence, this now cycles until one player reaches the green, choosing appropriate clubs from his bag on the way, when the SGM indicates that the relevant player should move to the putting mat (putting green). The system recognises which player is behind and gives him the shot during the entire process. Selecting a free golf ball, and positioning it as far away from the hole as indicated on the scroll (there are 2 ft and 8 ft circles on the scroll to indicate distances), the leading player chooses a putter from his bag and attempts to putt the ball in the hole. If he succeeds, the hole is over. The machine then needs to be manually reset by winding on the scroll (or if needed, changing the scroll between the 9th and 10th holes) and rewinding the gravity motors in the display by moving the travellers down by protruding tabs. A sample hole from a scroll is shown in Figure 5; note the programming slots at the left and right, sensed by the travellers.

Note that each player uses his own clubs and makes appropriate shots as required, based on the scroll data and aiming at the target flag on the safety net. The player chooses clubs, directions, lofting and force of stroke. The players keep their own score cards. There is no print or score facility.

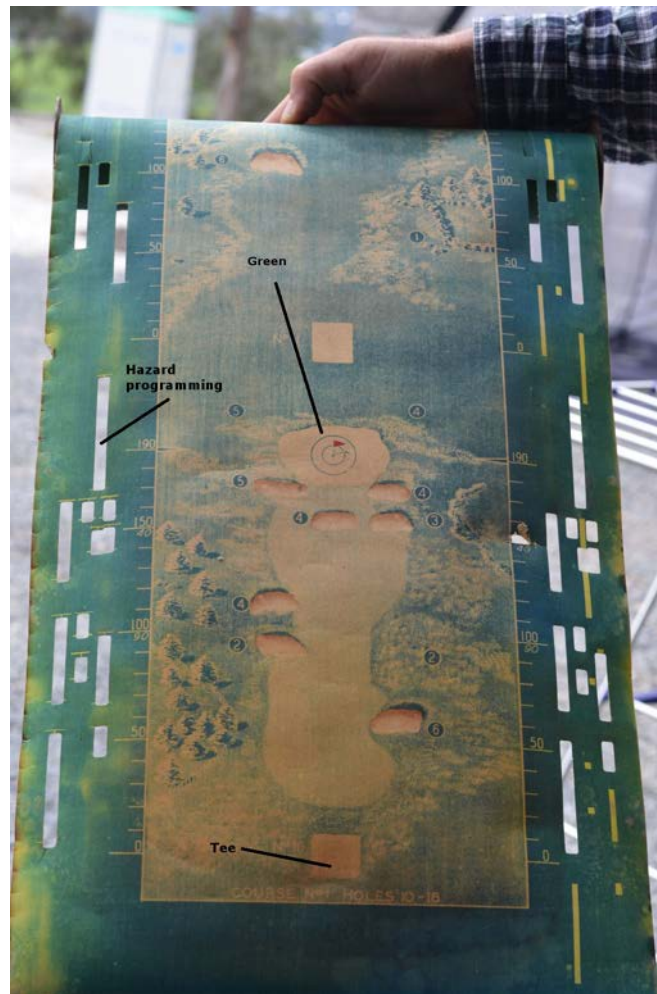


Figure 5 – Hole 10 from a surviving Course 1 scroll

Virtual-world complications

Slicing of the ball left or right so that it would go out of bounds is detected and indicated.

The course may contain hazards including sand bunkers, rough grass, and water. If the ball would land in one of these, the SGM computes this event, lights a central blue light on the front door, and applies constraints. The scroll visually shows the depth/height of the hazard as a number of feet, and the player must choose a club that will loft the ball sufficiently to clear the hazard. Insufficient elevation will not get the player out of the hazard. If unable to get out of the hazard (for example when practising or when the ball is in water) there is a button on the front door of the display that repositions the ball centrally and temporarily disables the immediate hazard, at the cost of a stroke penalty.

If the ball lands just short of a hazard, the SGM detects this too, and applies appropriate constraints so that a following inadequate shot will fall into the hazard.

One can turn off the two-player game and play as a single-player using only the left traveller. The switch is on the left side of the display unit, next to the On/Off switch.

Stepping on the tethered ball string or otherwise impeding it at any time invalidates the transduction, so the virtual ball will not travel as far. This includes hitting the safety net or a wall or ceiling.

A single scroll carries a display of 9 holes, so a pair of scrolls provides for the normal 18 holes. Games on machines installed in clubs were advertised for about 3 shillings per hour, or comparable prices, in many countries.

Limitations

Remember this is 1936. The first recognized 'numerical' electronic computer had not yet been designed, let alone built.

The transduction of the ball's azimuth and elevation after striking is digitized to a sufficient accuracy (2 and 4 bits respectively). The ball velocity is measured as a binary digital-signal, analog-duration signal. The display operates with a sense of similarity to reality in ball flight time.

There is no measurement of ball spin, in any direction, nor could the ball spin because it is captive. The horizontal distance travelled is an approximation to the probable distance, but is not 100% accurate. The effect of wind is not considered, and neither is air temperature nor humidity.

The holes are restricted to more or less straight fairways. A severe dogleg would be difficult to accommodate on the display.

Conclusions

The game was successful. It filled a valuable niche market. Available records show that it was marketed and demonstrated in Australia, New Zealand, Singapore, Great Britain, the USA, and Canada. Both 220V 50Hz and 110V 60Hz models were produced, as well as models powered by a lead-acid battery.

Safety is well catered for. The safety net is exactly that, just in case someone hits the ball so hard it might hit the wall. There is provision to stop balls hitting the ceiling too, with a limiting string. The high-voltage wiring is confined to the lower compartment of the display unit, which is not usually user-accessed. Elsewhere there is just safe 10 V wiring.

The design is assessed as robust, needing little maintenance, partly because of its digital nature. It would not have been much affected by climate. The engineering is excellent. The chief losses over time have been the paper components: cardboard boxes, the scrolls, instruction books, etc. The vulcanised rubber electrical wiring insulation is perished, but at 6 – 10V it is probably still adequate if undisturbed. The mains power supply is probably unsafe and unworkable, as is the mains cord and wiring, but can be easily replaced by a modern dc power supply and cord. Chromium plated external components such as handles and trim show slight rust after 77 years.

The display unit is an impressive piece, built of solid English Oak. It polishes up very well and the oak is in good condition. The back of the unit has cheaper timber, possibly plywood, with minor woodworm holes. The floor unit is contained in a solid tortoise-like metal shell or carapace.

The Spotlight Golf Machine is an amazing precursor to general purpose computers, and possibly the first computer game still in existence.

Acknowledgments

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References

Online

1. Australasian Golf Museum. *Spotlight Golf Machine*. <http://www.ausgolfmuseum.com/media/>. Accessed 1 Dec 2013.

Selected Newspaper clippings

2. Advertisement by Mick Simmons Ltd, *Sydney Morning Herald*, 1936.
3. *Referee* (Sydney, NSW: 1886 - 1939), Thursday 11 March 1937, p3.
4. *Nottingham Evening Post*, Saturday 27 March 1937.
5. *Picton Post* (NSW: 1907 - 1954), Wednesday 19 January 1938, p3.
6. *Gippsland Times* (Vic: 1861 - 1954), Monday 3 April 1939, p8.

Appendix 1 – Modern reproduction of the Abridged Instructions

(Reproduced through digital photo processing techniques)

