



Transforming Café Spaces Through Adaptive Furniture **A Study of A Vertical Retractable Table with Integrated** **Chair Parking**

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ABSTRACT

Cafés are now used for much more than eating and drinking. Depending on the time of day, the same space may serve as a place to meet friends, work independently, hold an informal discussion or organise a small event. A fixed arrangement of tables and chairs can make these changes difficult, especially when staff have to move furniture by hand and there is little space available to store it. This paper examines a proposed response: an Adaptive Café Furniture System in which a table moves vertically towards the ceiling and carries two rigid, non-folding chairs secured on top of the tabletop when parked. The study takes an exploratory, design-based approach. It draws on writing about café environments, servicescapes, environmental psychology, human-centred design and flexible spaces, and considers how observation, questionnaires, spatial analysis and design development could be used to assess the proposal. The paper describes the intended layout, the main parts of the system and the issues that would need careful attention, including guided movement, an electric linear actuator, mechanical locks, travel limits and secure chair retention. It also considers questions that go beyond the amount of floor space that might be cleared: customer comfort, accessibility, confidence in safety, maintenance and coordination with the ceiling and building services. The system has not been validated through a working prototype. For that reason, this paper does not claim measured space savings, confirmed survey results, lifting capacity or structural performance. Instead, it sets out the design proposal and identifies the research and testing needed before it could be considered for installation.

Keywords: café interior design; user experience; adaptive furniture; vertical retractable table; integrated chair parking; spatial flexibility; electric linear actuator.

1. INTRODUCTION

Cafés are no longer used only for refreshments. People may visit to meet friends, study, work on their own, celebrate an occasion or take part in a small group activity. As a result, one interior may need to support several different ways of using the space. A layout that works well for everyday dining may feel crowded or restrictive when the café hosts a workshop, gathering or performance.



The way furniture is arranged has a direct effect on how a café operates. Tables and chairs determine where customers can sit, shape the paths people use to move through the room and influence how easily staff can serve and clean. In many cafés, furniture stays in the same floor position throughout the day. When the room needs to be cleared, staff may have to move each item, find somewhere to keep it and later put everything back. This takes time and can interrupt normal service.

The design issue is not always a shortage of floor area. It can also be the difficulty of changing the way that area is used. A café may need to operate as a dining room during regular hours and become a more open space for an event later in the day. Any proposed solution should make that change easier without creating new problems for comfort, safety, appearance or staff workflow. The proposed system is considered as part of an overall interior strategy rather than as an isolated mechanical object. Its value depends on the relationship between the moving furniture, the structural ceiling, building services, circulation routes, staff procedures and customer expectations.

2. AIM AND RESEARCH OBJECTIVES

The aim of this study is to explore how a vertically retractable café table with integrated chair parking could contribute to spatial flexibility and user experience in a multi-use café interior.

- To examine how café layout, furniture arrangement and environmental conditions influence customer and staff experience.
- To identify operational challenges associated with changing a café from a dining arrangement to an open activity arrangement.
- To develop a preliminary vertical retractable table concept with a defined chair-parking arrangement.
- To identify design, ergonomic, structural and safety conditions that must be addressed before the system can be used in a public interior.
- To establish an evaluation framework covering flexibility, comfort, accessibility, perceived safety, cleaning, maintenance and operational practicality.

3. LITERATURE REVIEW AND CONCEPTUAL FRAMEWORK

3.1 CAFÉS AS SOCIAL AND EVERYDAY PLACES

Cafés can be understood as social settings where people spend time beyond the act of eating or drinking. Oldenburg's (1989) discussion of the 'third place' highlights the value of informal gathering places outside home and work. In interior-design terms, this means that a café may need to support different patterns of occupation, from brief individual visits to longer conversations and group activities. Furniture, seating choice, circulation and the degree of openness can influence whether these activities are comfortable.

3.2 THE SERVICESCAPE AND ENVIRONMENTAL EXPERIENCE

Bitner's (1992) servicescape framework explains that the physical surroundings of a service environment can influence both customers and employees. Spatial layout, functionality and



ambient conditions contribute to how a place is experienced and how work is carried out. For a café, furniture is therefore not only a visual feature; it also affects movement, service access, cleaning and the interaction between customers and staff.

Mehrabian and Russell's (1974) environmental psychology model provides a further basis for considering how environmental conditions relate to human responses. Applied cautiously to café design, this perspective encourages the designer to examine whether a space feels comfortable, inviting, crowded, confusing or reassuring. The proposed furniture system must consequently be judged through more than its mechanical operation.

3.3 HUMAN-CENTRED DESIGN AND USABILITY

Human-centred design places users, their tasks and their context at the centre of the design process. ISO 9241-210:2019 sets out principles for human-centred design in interactive systems. Although the proposed café furniture is a physical product within an interior, the underlying principle is relevant: operating procedures, controls and feedback should be understandable to the people expected to use them. Customers, service staff, cleaning staff and managers may have different needs and concerns.

Norman (2013) also emphasises the importance of discoverability, feedback and understandable controls in the design of everyday things. In the proposed system, staff should be able to recognise whether the table is in a secure position, understand when movement is permitted and know what to do if an error occurs. These are design requirements, not features that can be assumed to work without testing.

3.4 SPATIAL FLEXIBILITY AND ADAPTIVE FURNITURE

Flexible interiors are intended to accommodate changing activities without requiring a complete redesign of the space. Transformable or movable furniture can contribute to this goal, but flexibility is useful only when the transformation is practical. A system that requires complex preparation, frequent maintenance or specialist intervention may create new operational difficulties. It should therefore be compared with simpler alternatives such as stackable chairs, folding tables, movable partitions and dedicated storage.

3.5 RESEARCH GAP

The literature provides a foundation for understanding café atmosphere, servicescapes, human-centred design and the relationship between physical environments and behaviour. Historical patent records also show that ceiling-suspended or retractable tables have been explored previously. The general idea of raising a table towards a ceiling should not, by itself, be described as a new invention. The specific design direction examined here is the integration of a ceiling-supported vertical café table, a secure parking arrangement for two rigid chairs on the tabletop, a central guide that does not touch the floor, and defined dining and event positions. Its contribution must be assessed through spatial planning, user experience, safety and operational requirements.



4. RESEARCH METHODOLOGY

4.1 RESEARCH DESIGN

This research uses an exploratory design approach. It brings together a review of relevant literature, observation of café environments, consideration of user needs, spatial analysis and the development of a furniture concept. The sequence is intended to keep the proposal connected to the needs of the space: first understand how the café is used, then identify the difficulties, establish design requirements and develop a response that can be evaluated.

4.2 DATA COLLECTION

Potential primary-data methods include site observation, measured drawings, photographs taken with permission, short interviews and a structured questionnaire. Observation should record seating arrangements, circulation routes, customer and staff movement, cleaning practices, furniture storage and any changes made for events. Secondary information may be drawn from books, peer-reviewed articles, design guidance, manufacturer documentation, case studies and patent databases.

The thesis identifies café visits to Vicolo Café, Bake N Shake at Bawadiya Kalan, Lamington Café at 10 No. Market and Romeo Lane near Rani Kamlapati, Bhopal, as case-study contexts. The observations are intended to consider space planning, furniture, lighting, materials, ambience, accessibility and user movement. Specific measured dimensions, operational data and staff comments should be included only where they were actually recorded and permission allows their use.

4.3 USER GROUPS AND EVALUATION CRITERIA

The relevant user groups include café customers, service staff, cleaning and maintenance staff, and owners or managers. Customer-related criteria include seating comfort, ease of movement, perceived safety and the suitability of the environment for different activities. Staff-related criteria include operating clarity, time and effort required for transformation, access for cleaning, inspection and maintenance. Management-related criteria include installation requirements, reliability, cost and the effect on daily operations.

4.4 EVIDENCE AND LIMITATIONS

The source thesis does not provide a complete, auditable dataset containing respondent numbers, questionnaire response distributions, verified site measurements or controlled prototype results. Although it includes a narrative description of mixed survey opinions, the supporting counts and percentages are not available in the material reviewed. Accordingly, this paper does not present numerical survey findings or measured performance claims. Any final empirical version should insert the actual sample size, survey dates, response tables, site measurements and method of analysis.



5. PROPOSED ADAPTIVE CAFÉ FURNITURE SYSTEM

5.1 DESIGN CONCEPT

The proposed unit is a circular café table that can travel vertically between its everyday dining position and a raised parking position near the ceiling. When the floor needs to be opened up, the table and its two chairs are intended to move together. The chairs are rigid and do not fold. They are positioned and secured on the upper surface of the tabletop for storage; they are not placed below the table. A purpose-designed retaining arrangement is essential so that the chairs cannot slide, tip or become detached while the unit is moving.

5.2 SPATIAL PLANNING STRATEGY

The retractable units are not intended to replace every table in the café. The design proposes a mixed layout, with a conventional seating area and a separate zone where the retractable furniture can be used. This allows everyday dining to continue in one part of the café while another part can be cleared for a workshop, gathering or other activity. The raised furniture must be planned around the real ceiling height and must not conflict with lights, sprinklers, detectors, air-conditioning equipment, signs or escape routes.

5.3 TABLE AND CHAIR CONFIGURATION

The design brief considers a circular tabletop with an approximate diameter of 750–850 mm, intended for one or two users. These dimensions are preliminary and should be checked through ergonomic drawings and a full-scale mock-up. The final arrangement must allow comfortable seating and sufficient knee and leg space. In the raised position, two rigid chairs are secured on top of the tabletop using locating points and retaining components. Simply placing the chairs on the surface would not provide adequate security.

5.4 VERTICAL GUIDE AND STRUCTURAL SUPPORT

A central support and guide is proposed between the building's structural ceiling or an engineered frame and the underside of the table assembly. It travels with the moving unit and stops at the underside of the table; it does not continue down to the floor. Its purpose is to guide the table along a vertical path and help control unwanted movement. The final guide arrangement, section size, material and connections must be established through engineering calculations rather than selected from appearance alone.

The system must connect to a verified structural slab, beam or engineered frame. A decorative false ceiling is not a suitable load-bearing support. The installation must be coordinated with ceiling services and inspected by qualified professionals.

5.5 ACTUATION AND CONTROL

The design concept uses an electric linear actuator to raise and lower the table. The correct actuator cannot be selected by looking at its advertised force rating alone. The design team would need to calculate the full moving load, account for movement and starting forces, and check the required stroke, speed, operating frequency, mounting points and manufacturer's



limits. The actuator should not be relied upon as the only component holding the furniture overhead.

The design should include independent mechanical locking at the required positions, upper and lower travel limits, controlled movement, clear operating controls and a defined emergency procedure. Sensors may be considered for position, obstruction, overload or chair-retention status. Their selection and logic require a formal risk assessment and engineering design. A power failure or component fault must not result in an uncontrolled descent.

5.6 SAFETY, MAINTENANCE AND ACCESSIBILITY

Moving furniture above floor level introduces risks that are not present with ordinary café tables. The system should therefore be operated only by trained staff, with customers kept outside a defined exclusion area while it is in motion. Mechanical locks, chair-retention parts, guide connections, anchors and electrical controls all need inspection and a maintenance record. Any prototype should be tested in a controlled area, away from customers, and only after review by appropriately qualified professionals.

Accessibility must be considered in both modes. The normal arrangement should provide usable approach and circulation space, while the event arrangement should not create overhead hazards or obstruct accessible routes. Controls should be positioned and designed for authorised staff rather than requiring customers to operate the system.

5.7 MATERIALS, FINISHES AND LIGHTING

The furniture should use durable, maintainable finishes suitable for a commercial café. Material selection must consider weight, cleaning, impact resistance, repairability and compatibility with the moving mechanism. The thesis also proposes integrated lighting at the table edge and a central cylindrical light element. Electrical wiring and lighting components must be protected from movement-related damage and must not interfere with the guide, actuator, locks or inspection access.

6. DISCUSSION

The proposal responds to a practical planning challenge: a café may need to use the same floor area for routine dining and occasional activities that require more open space. If the table and its chairs can be parked overhead, staff may not need to carry every item to a separate storage room. The cleared floor may also be easier to sweep or prepare for an event. These are possible advantages of the design, however, and should not be presented as proven results until the system has been built and evaluated.

There are also important disadvantages to consider. Overhead furniture may change the appearance of the ceiling and will need regular inspection. The building must have suitable structural support and enough clear height, and the mechanism must be coordinated with existing services. Installation may cost more than using stackable chairs or folding tables. These alternatives should be compared fairly before a café owner decides whether a retractable system is worthwhile.



The experience of using the café should be assessed from several angles. Customers may appreciate a more open floor but still feel uneasy about furniture being stored overhead. A clear floor may make cleaning easier, but the raised furniture and its mechanism will also need cleaning and inspection. For this reason, the evaluation should look separately at comfort, accessibility, perceived safety, technical safety, ease of operation, maintenance and cost. A positive response to one of these factors does not automatically mean that the system performs well in all the others.

A useful evaluation should compare the proposal with practical alternatives. Stackable chairs and folding tables may be less expensive and easier to maintain. Movable partitions may support zoning without overhead loads. A retractable system may be justified only where the value of rapid floor clearance and the lack of suitable storage outweigh installation, engineering, inspection and maintenance costs.

7. CONCLUSION

This paper has examined a furniture concept for cafés that need to support both everyday dining and occasional activities requiring a clearer floor. The proposal brings together a vertically moving circular table, two rigid chairs secured on top of the tabletop during storage, a central ceiling-supported guide that does not touch the floor, and an electric linear actuator. It is intended to work as part of a wider interior plan that also considers fixed seating, circulation, accessibility, staff activity and ceiling services.

At this stage, the value of the study lies in setting out the concept and identifying the conditions that would need to be met before it could be used. The idea may offer an alternative to manually moving tables and chairs, but its performance has not yet been demonstrated through a verified working prototype. No confirmed claim is made about the amount of floor area saved, the time needed to raise or lower the unit, its load capacity, the strength of the building support or its patentability.

Further work should begin with a clearly documented site study and genuine feedback from customers and staff. A full-scale mock-up, initially without a powered lifting mechanism, could help check the table size, chair positions, clearances and visual effect. Qualified engineers would then need to assess the structure, anchors, guide, actuator, locks and possible failure conditions. Only after those checks should a controlled prototype be tested away from the public. Its performance should be compared with simpler options using evidence about cost, time, usability, safety and maintenance.

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