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THE APPLICATION OF DIGITAL TECHNOLOGY IN AGE-FRIENDLY PACKAGING DESIGN

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As China's ageing population becomes increasingly pronounced, the application of digital technology in packaging design has become particularly crucial. This study systematizes digital strategies in age-friendly packaging design and evaluates their ergonomic and functional effectiveness through case-based analysis. It outlines the current state of digital technology applications in packaging design, focusing on exploring its innovative implementation and consequential effects within an ageing societal framework.

Key words: Packaging design; Age-friendly design; Digital technology; Ageing society; Visual communications design.

INTRODUCTION

The United Nations' 2024 World Population Prospects indicate that by the late 2070s, the global population aged 65 and over will surpass those under 18; in China, the elderly population is expected to exceed 400 million by 2035 [1]. As ageing accelerates, older adults' demands for easy opening, clear information, and product safety are becoming increasingly prominent. Digital technologies offer new tools to enhance accessibility and usability in packaging. Through analysis of digital design tools and selected case studies in aging societies, the study formulates practical strategies for age-friendly packaging design.

PURPOSE

The purpose of this study is to identify and systematize digital design strategies that improve functional accessibility, information perception, and safety of packaging for elderly consumers.

RESULTS AND DISCUSSION

Digital technologies transform packaging from a static container into an interactive medium that addresses both physiological and psychological needs of elderly users. interactive media that address the dual physiological and psychological needs of older users. Such innovations reflect both meticulous care for the ageing population and a proactive commitment to social responsibility. This study adopts case study and comparative analysis methods, selecting representative examples of age-friendly packaging to evaluate the effectiveness of AR technology, smart alerts, and eco-friendly materials. Ergonomic assessments based on elderly users' visual, tactile, and operational habits are also employed to validate the usability and safety of digital designs. AR technology addresses the



common difficulty of reading small-print instructions. By scanning package patterns with a smartphone, elderly users can access enlarged, voice-guided 3D demonstrations. This dual-sensory approach not only ensures correct product use but also alleviates apprehension toward new technologies, enhancing emotional satisfaction during interaction. In a nutritional supplement packaging project, AR technology was integrated to provide interactive three-dimensional product visualization and instructional guidance. After scanning the QR code and installing the application, the design on the packaging can be viewed in 3D. Shaking the packaging causes the liquid within the 3D capsule to move accordingly (Fig.1-a). For pharmaceutical packaging, smart packaging technology can incorporate medication reminder functions. When elderly individuals require their medication, the packaging emits an audible or visual signal. Furthermore, through built-in sensors, the packaging can monitor the product's condition in real time—such as temperature and humidity—ensuring the product's safety and efficacy during storage and transportation [2]. For instance, each compartment of the smart pillbox features an independent LED indicator. When medication is due, the corresponding compartment illuminates upon opening, thereby mitigating the risk of medication errors or missed doses, the medicine compartment lid employs a combined “press and twist” opening mechanism. From an ergonomic perspective, this design takes full account of the diminished hand strength and reduced fine motor skills commonly experienced by the elderly (Fig.1-b). Digital technologies empower designers to select eco-friendly materials for packaging. Through simulation and testing, optimal recycled or biodegradable materials can be identified to replace conventional plastics, thereby reducing waste. Digital tools optimise packaging structures and shapes, minimising material usage while enhancing strength. This approach not only lowers production costs but also alleviates environmental burdens [3]. For instance, employing bamboo or sugarcane fibre to craft eco-friendly packaging boxes, substituting shopping bags with corn starch-based plastics, designing reusable glass bottles or metal tins, and utilising polylactic acid (PLA) materials for food packaging. Lightweight biodegradable materials also reduce handling effort, which is particularly relevant for elderly users with limited grip strength (Fig.1-c).

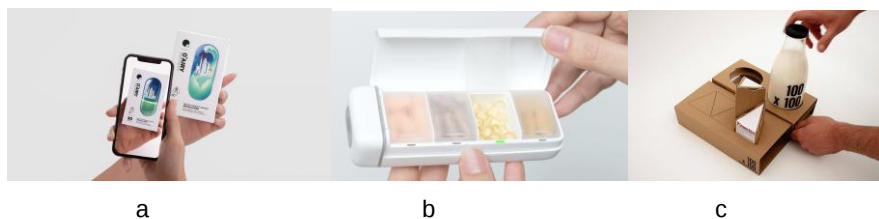


Fig.1. Packaging Design in the Digital Age: a-Packaging with AR; b-Intelligent packaging; c-Packaging made from environmentally friendly materials.



However, current digital age-friendly packaging overly relies on smartphones and applications, overlooking the limited technological accessibility faced by some elderly users. Not all older adults utilise smart devices. Future designs should accommodate both traditional and non-smart interaction methods, such as simplifying physical structures and enhancing tactile identification. This ensures the benefits of technology reach a broader elderly demographic, preventing the digital divide from exacerbating usage barriers.

CONCLUSIONS

This paper explores how digital technologies have opened up new dimensions for age-friendly packaging design. The application of digital techniques in packaging design work provides enhanced technical support for age-friendly packaging solutions. Through digital packaging, effective responses are delivered to the safety requirements of elderly populations facing declining physiological functions and complex medication regimens. Looking ahead, as intelligent technologies continue to evolve, digital age-friendly packaging will further integrate emotional care with health management functions, offering innovative design pathways to proactively address population ageing.

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ЗАСТОСУВАННЯ ЦИФРОВИХ ТЕХНОЛОГІЙ У ДИЗАЙНІ УПАКОВКИ, ОРІЄНТОВАНИЙ НА ЛЮДЕЙ ПОХИЛОГО ВІКУ

У контексті стрімкого старіння населення Китаю питання адаптації дизайну упаковки до потреб людей похилого віку набуває особливої актуальності. У статті досліджується потенціал цифрових технологій як інструменту підвищення функціональності, доступності та пакетів безпеки для старших користувачів. Проаналізовано демографічні передумови формування нових вимог до упаковки, визначено ключові напрями інтеграції цифрових рішень у дизайн-практику та окреслено їх вплив на взаємодію людини з продуктом. Особливу увагу приділено інноваційним підходам, які сприяють підвищенню ергономічності, інформативності та емоційної привабливості упаковки в умовах старішого суспільства.

Ключові слова: дизайн упаковки; дизайн, зручний для людей похилого віку; цифрові технології; старіння суспільства; дизайн візуальних комунікацій.