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Research Article

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Perfume Design Map: A Scientific Framework for Creating Accords Formulation from Fragrance Families

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ABSTRACT

This research focused on developing a scientific perfume design map by systematically combining different fragrance families to generate structured accords. The experiments involved selecting representatives from four main aromatic family's floral, fruity, citrus, and spicy (with woody as a complementary option) and mixing them in graded proportions represented by drops on blotting papers. Through this systematic approach, approximately 1187 possible accords were created, including 150 accords from mixing two families, 500 accords from three families, and 625 accords from four families, with a small number of duplicates identified and excluded. Additional experiments demonstrated the special role of oud as a dominant "mold" rather than a decorative element, producing 60 unique oud-based accords. The study also established three key construction rules for perfumes: proportion gradation to avoid clashes, maintaining a dominant identity (mold vs. decoration), and ensuring balance for attractiveness. The most important result was the creation of a quantitative and reproducible framework for perfume formulation, showing that from just a few raw materials, hundreds of harmonious and diverse perfumes can be designed efficiently using this systematic mapping method. This study proves that perfume creation can move from chance and tradition to a reproducible scientific process, enabling the design of thousands of innovative fragrances from just a few raw materials.

INTRODUCTION

There is a treasure filled with jewels, and this is the roadmap. The treasure is the world of perfumes, and the map is the perfume design map. World of perfumes is a mysterious world full of puzzles and valuable secrets. Perfumes reflect beauty, pleasure, and a sense of luxury on those who work with them, especially in the profession of perfume design. World of perfumes is still awaiting development and organization, after the emergence of modern technology. Likewise, humanity is still on the verge of this science, and whoever discovers something from this science is considered one of the greats. The field of perfumes combines art and science, and it is also related to many fields such as psychology, behavior, organ functions, chemistry, botany, art, geology, and analysis (Sell & Sell, 2006).

Perfumes are the mysterious secret that affects humans, as the perfume atoms, after converting into electrical signals, interact with the upper layers of the central nervous system, and affect the psyche, behavior, and emotions. Where the olfactory bulb (the center of smell) is located next to the center of memory and emotion. A short time ago, humanity did not have an explanation for the sense of smell, because it is related to the detection of brain electricity. With recent developments in devices and technologies, anatomists and physiologists have become able to explain the mechanism of the sense of smell, and prove the strong relationship between fragrance molecules and the organic and psychological state of a human being (Velasco-Sacristán & Fuertes-Olivera, 2006).

Correspondingly, designing perfumes will not be difficult. The map helps us to get about 1187 different perfumes from only 4 perfumes, and it will only take a few hours. Everyone cooperates and works as a team. The world of perfumery awaits every hard-working person to write their name on it.

This investigation offers a humble and simple task for all workers, enthusiasts, teachers, and perfume designers worldwide, to be a help and guide. Although the world of perfume design is one of the most enjoyable professions, it remains a challenging and arduous task, and not an easy one. And since this is our profession as perfume designers, statistics can be used to facilitate the task. Therefore, the creation of a perfume design map was and continues to be a learning experience. Credit goes to the developers of modern perfumery, the innovators and scientists who care about more than perfume design, but rather the impact of perfumes on the psyche, behavior, and emotions, for pioneering the third era of perfume design: physiological, psychological, and emotional perfumes, with the aim of achieving peace and security for the soul, family, and society (Mossad Hassan, 2025).

In the following sections, we map the rich historical context and literature, outline the raw materials and fragrance families used, define the construction rules, detail experimental methods and results, and finally link these findings to modern scientific advances statistics, biotechnology, and sustainability. With clear metrics and construction guidelines, the perfume design map advances the field toward a new era in which fragrance creation is both scientifically rigorous and emotionally engaging.

The Story of Perfumes and Human Life

Man lived exploring nature, and the perfume remained imprisoned in its flower. The perfume continued to entice man's desire through the sense of smell and his instinct to explore what benefits him and what he needs. Man, that living being that consists of 30 to 37 trillion cells, diversifying into 200 types to form the rest of the body's organs, is controlled by the five senses, which are the arms of the brain that he relies on in making his decisions. Hearing, sight, touch, taste, and smell, including the senses of taste and smell, which are called chemical senses that depend on chemical reactions between the external environment and saliva in the mouth and olfactory receptors in the nose (Simco, 1981 and Pybus *et al.*, 1999).

Human life is confined between two things: desire and suffering. Man's desire to live in the world enjoying it. He resorts to food, drink, and social life, and suffers from illness, death, heat, cold, and homelessness. The senses capture what may destroy human life and cause him troubles and pains, then flowers come with their wonderful scent to send a message of containment and reassurance to humans, taking him to another world and transporting him to luxury and the world of beauty and pleasure. Man used to resort to beautiful flowers to seek their fragrance, and the beauty of the fragrance increased in his eyes whenever he looked at the beauty of the mold in which it is presented, which are roses with their beautiful colors. He used to pick the rose and carry it with him to his home, to his temple, and to his loved ones, so perfumes have been associated since their early days with happy occasions, as they symbolized beautiful and important feelings, including worship and sanctification, and emotional relationships between men and women. Man used flowers for fragrance, by grinding, then anointing them on his body or clothes, and also burning, and from this came the word PERFUME from the Latin PER FUMUM, which meaning through smoke. Man used to enjoy roses and take them to his home to inhale their smart fragrance, but within days, the rose would wither and die, and its fragrance would die with it (Pearlstine, 2022).

The History of Perfumes

For thousands of years, man kept searching for inspiration, and inspiration kept searching for him. He kept looking at the roses and the fragrance within them, as if he heard a faint voice coming from inside the rose, like the voice of a prisoner trapped inside. It was the voice of the fragrance, as if it was calling him to free it from within to roam with him anywhere. A man stood still, not knowing how to extract the perfume from within, as the perfume particles evaporate with rising temperatures. When plants are boiled in water, the perfume particles evaporate with the water vapor. But how can the perfume particles that have evaporated with the water vapor be collected again? He found that the solution was also to lower the temperature, and that was the idea behind "the condenser" (Gomes, 2005).

Moments and Jabir Ibn Hayyan knocks on the door of knowledge, opening the way for him to take the first steps in the existence of perfumes in human life. Finally, someone came from among humans who was able to free the perfume from its confinement. Finally, perfume will roam with us wherever we are in a small bottle, traveling between countries. Finally, perfume has become a garment worn by those who love it. Perfume has become free, roaming the world of humans, playing its role in life, through his invention of the alembic or still (721 AD - 815 AD). Then, Al-Razi (921 AD - 866 AD) and Ibn Sina (980 AD - 1037 AD) developed distillation methods, and distillation devices quickly spread. It was a unique era, and from that date until now, Europe, especially France, and particularly its south, the city of Grasse, has become the capital of perfumes in the modern world (Dowthwaite, 1999).

Humans rejoiced in the existence of perfume, and the profession of perfumer quickly spread, through mixing and isolation, and the science of perfume chemistry was born by isolating and mixing compounds, and the art of glass and alcohol. However, perfume remained limited to the wealthy classes, as from a million roses we get a kilo of oil, and from 7 million jasmine flowers we get a kilo of oil (Rinasty, 2017). Since then, perfumery has become both a cultural heritage and a scientific discipline, shaping aesthetics, identity, and emotional well-being. Therefore, modern man is used to seeing perfumes associated with fun and games, luxuries, adornments, attractiveness, and the romantic relationship between men and women. But scientists specializing in psychology, behavior, and physiology have discovered that perfumes are much more important than that, especially since aromatic compounds have a therapeutic effect on the psyche, behavior, and healing from many diseases. Scientists believe that the sense of smell is the most mysterious, complex, and most important of all senses. This is because the center of the sense of smell (the olfactory bulb) is connected to the limbic system, which is the center of emotion, and it has the ability, above all other senses, to transport us in a moment to another world and another time through memories or to penetrate our psyche to influence the human mood (Pybus & Sell, 2007).

Cultural and Historical Dimensions

The earth brought forth a buried treasure, which is petroleum. Humans obtained tons of essential oils at the cheapest prices, and today perfume has reached everyone. In the early 19th century, Perfumes flourished and fashion houses spread, and beautiful bottles. The interests of writers, historians, and philosophers have not been devoid of interest in perfumes, since the first manuscript of human history 3200 BC, through Aristotle, who said: Good smells help in the well-being of humanity and the founder of the theory of smell, Titus Lucretius 90 BC. And developers of the world of perfumes in the modern era, such as: Gabrielle Coco Chanel, and François Coty, Guerlain, Jean Paul Gaultier, Jean-Claude Ellena, Roja Dove, and Delphine Arnould (Myjkowski, 2023).

The ephemeral history of perfume is explored in early modern England, focusing on the cultural, social, and sensory dimensions of scent rather than laboratory-based experimentation. The research examined how perfumes were produced, circulated, and experienced during this period, drawing on literary, medical, and historical sources to reconstruct the role of fragrance in daily life and symbolic practices. The study highlighted that perfumes were not only valued for their pleasant aromas but also for their associations with health, spirituality, and social identity, reflecting beliefs that scents could influence both the body and the mind. The most important result of this work was the demonstration that perfume functioned as a powerful cultural and psychological agent, shaping behavior, emotions, and perceptions in early modern society, and that its history reveals much about how people understood the relationship between scent, sense, and human experience (Dugan, 2011 and Lowe *et al.*, 2003).

Similarly, Jung (2022), in *An Ethnography of Fragrance: The Perfumery Arts of ‘Adan/Laḥj*, conducted ethnographic experiments through immersive fieldwork, interviews, and sensory participation to investigate the cultural practices, techniques, and meanings of perfumery in southern Yemen. The most important experiments involved documenting the preparation and use of traditional perfumes, analyzing the role of local ingredients such as oud, rose, and spices, and observing how fragrances were embedded in rituals, social interactions, and expressions of identity. The key results revealed that perfumery in ‘Adan and Laḥj is not only an aesthetic practice but also a deeply social and symbolic art, linking memory, heritage, and spirituality. This research demonstrated that fragrance functions as both a cultural marker and a medium of emotional communication, highlighting the inseparability of scent from social life and identity in the region.

Legal and Intellectual Property Perspectives

Cronin (2008), in *Genius in a Bottle: Perfume, Copyright, and Human Perception*, conducted interdisciplinary experiments combining legal analysis, sensory studies, and case evaluations to explore whether perfumes can be protected under copyright law. The most important experiments involved examining court cases on perfume copyright, analyzing the chemical and perceptual distinctiveness of fragrances, and testing how human perception identifies and differentiates scents. The key results showed that while perfumes can be scientifically characterized by their molecular compositions, human perception of scent is highly subjective, making legal recognition of originality and authorship problematic. This research demonstrated that perfumes occupy a unique space between art and science, where their creative and perceptual value is evident, but their legal protection as intellectual property remains contested.

Creative and Artistic Perspectives

Haines (2012), in *Osmologies: Towards Aroma Composition* conducted experimental research that blended artistic practice with sensory science to explore how aromas can be composed and understood as a structured medium, similar to music or visual art. The most important experiments involved creating and testing olfactory compositions through controlled blending of aroma materials, analyzing how participants perceived, described, and interpreted these scent structures, and comparing sensory responses across cultural and contextual settings. The key results showed that aroma composition follows discernible patterns of harmony, contrast, and balance, and that human perception of scent is shaped as much by cultural frameworks and language as by the chemistry of odorants. This work demonstrated that fragrance creation can be approached as a systematic and aesthetic practice, offering a new theoretical and experimental foundation for the emerging field of osmologies.

Likewise, Pimentel *et al.*, (2025), in *The Diatonic Sound of Scent Imagery*, conducted cross model perception experiments to investigate the relationship between musical structures and olfactory imagery. The most important experiments involved presenting participants with different fragrance descriptions and asking them to match these with diatonic musical scales, chords, and tonal patterns, while measuring consistency, emotional associations, and imagery vividness. The key results showed that people systematically associated certain scent qualities such as freshness, sweetness, or heaviness with specific musical intervals and tonalities, suggesting a strong cognitive link between olfactory and auditory domains. This research demonstrated that scent perception can be meaningfully “sonified” through diatonic structures, opening new possibilities for multisensory design, marketing, and cross model art forms.

Similarly, Spence *et al.*, (2024), in *Marketing Sonified Fragrance: Designing Soundscapes for Scent*, conducted multisensory experiments to examine how soundscapes can be designed to enhance consumer perception of fragrances. The most important experiments involved pairing different perfumes with specifically composed musical and acoustic environments, then measuring participants’ emotional responses, scent evaluations, and purchase intentions. The key results showed that congruent soundscapes such as light, airy music for citrus scents or deep, resonant tones for woody fragrances significantly enhanced perceived intensity, pleasantness, and memorability of the perfumes. This research demonstrated that sonification can be a powerful marketing tool, reinforcing olfactory branding and creating immersive multisensory experiences that shape consumer behavior.

Correspondingly, Islam *et al.*, (2016), in *Beyond ‘the Eye’ of the Beholder: Scent Innovation through Analogical Reconfiguration*, conducted organizational and ethnographic experiments to study how innovation in the fragrance industry emerges through creative processes rather than purely technical formulation. The most important experiments involved case studies of perfumery teams, interviews with perfumers and managers, and observations of innovation workshops where analogies from other sensory domains (such as music, taste, and color) were used to reconfigure fragrance design strategies. The key results showed that analogical thinking enabled perfumers to break traditional categories, generate novel scent concepts, and translate abstract brand identities into olfactory forms. This research demonstrated that successful scent innovation relies not only on chemistry and sensory testing but also on cross-domain creativity, where analogies serve as powerful tools for reimagining the possibilities of fragrance design.

Psychological and Biological Effects of Perfumes

Mensing (2023), investigated the psychological and sensory dimensions of perfumery through experiments examining how specific fragrance ingredients influence user perception, memory, and well-being. The most important experiments included controlled sensory tests where participants evaluated perfumes containing different key ingredients, assessments of emotional and cognitive responses to various fragrance families, and studies on memory retention linked to specific scents. The key results revealed that certain ingredients consistently triggered positive emotional states, relaxation, or stimulation, while others enhanced the memorability of perfumes and their associations with personal experiences. The research demonstrated that perfume is not only a sensory product but also a psychological tool, shaping consumer identity, emotional well-being, and long-term brand loyalty.

In addition, Rhind (2013), in *Fragrance and Wellbeing: Plant Aromatics and Their Influence on the Psyche*, conducted experimental and clinical studies to explore how plant-derived aromatics affect psychological health and emotional balance. The most important experiments involved administering essential oils such as lavender, rosemary, and citrus oils through inhalation and topical application, followed by assessments of mood, anxiety, stress, and cognitive performance in participants. The key results showed that specific plant aromatics produced measurable effects, such as lavender reducing anxiety and improving sleep quality, rosemary enhancing alertness and memory, and citrus oils elevating mood and reducing stress. This research demonstrated that natural fragrances can play a significant therapeutic role in supporting psychological wellbeing, providing scientific support for aromatherapy practices.

Whereas, Barwich (2013), in *Making Sense of Smell: Classifications and Model Thinking in Olfaction Theory*, conducted experimental research combining historical analysis, conceptual modeling, and interdisciplinary case studies to investigate how scientists classify and theorize the sense of smell. The most important experiments involved examining past and present models of olfaction, comparing molecular structure-based classifications with perceptual and psychophysical approaches, and analyzing how these frameworks shaped both laboratory practice and theoretical understanding. The key results showed that no single model fully explains olfactory perception; instead, classifications are influenced by the interplay of chemistry, biology, and cognitive science. This research demonstrated that olfaction theory is shaped as much by conceptual choices and model-building as by empirical data, highlighting the importance of interdisciplinary approaches for advancing the science of smell.

Also, Van Toller and Dodd (2013), conducted interdisciplinary experiments combining psychology and biology to investigate how fragrances influence human perception, mood, and physiology. The most important experiments involved psychophysical tests measuring emotional and behavioral responses to different scents, neurobiological studies examining olfactory pathways and brain activation, and physiological assessments such as heart rate, skin conductance, and hormonal changes triggered by fragrance exposure. The key results showed that perfumes can significantly affect emotional states, enhance memory recall, alter stress responses, and even influence social and sexual behavior. This work demonstrated that fragrance operates as both a psychological stimulus and a biological modulator, providing scientific evidence that perfumes shape human experience through complex interactions between the nervous system, emotions, and behavior.

The same authors, Van Toller and Dodd (1993), in *Fragrance: The Psychology and Biology of Perfume*, compiled experimental research that examined the psychological, physiological, and neurobiological effects of perfumes on humans. The most important experiments included psychophysical tests assessing mood changes and cognitive performance after fragrance exposure, physiological studies measuring heart rate, skin conductance, and hormonal responses to specific scents, and neurobiological investigations into olfactory processing pathways in the brain. The key results demonstrated that perfumes significantly influence emotional states, stress reduction, memory recall, and social behavior, with different fragrance families eliciting distinct psychological and biological responses. This work provided foundational evidence that perfumes are not only sensory stimuli but also powerful modulators of human psychology and physiology.

Industry and Social Dimensions

A new era in the development of perfume influential perfumes divided perfumes into two parts: stimulants and treatments. With the development of science, scientists were able to reveal the effect of scents on humans and the effect of perfumes on the human nervous system and the movement of brain cells, and with the development of human thought to look at perfumes with a more important view, which is treatment with perfumes, it was necessary to start a new era of human development to use perfumes. The perfume bottle has been delayed a lot in the development race. For thousands of years, it has not changed, perhaps it is time to break free again. It is the beginning of the third era of perfumes. For simplicity, the aromatic fragrant families are divided into 5 different families, using a special symbol for each family such as Floral (A), Fruity (B), Citrus (C), Spicy (D), Woody (E) (Mossad Hassan, 2025).

Kubartz (2009), investigated the geographies of knowledge in the international fragrance industry by conducting qualitative experiments centered on archival research, industry reports, and interviews with perfumers, chemists, and fragrance company executives. The most important experiments involved mapping how knowledge flows between major fragrance hubs such as Grasse in France, Geneva in Switzerland, New York, and emerging markets in Asia and analyzing how local traditions, scientific expertise, and corporate networks interact to shape innovation. The key results showed that the fragrance industry operates within a complex global knowledge network where cultural heritage, scientific research, and commercial strategies intersect, with certain regions specializing in raw materials, others in creative formulation, and others in large-scale production and marketing. This study demonstrated that the global fragrance industry is sustained not only by chemistry and artistry but also by the strategic circulation of knowledge across international geographies, making location and collaboration central to fragrance innovation.

Also, Barosco (2018), in *An Anthropology of Processes of Sensory Learning and Their Implications for Social Differentiation in the Field of Contemporary Perfumery*, conducted ethnographic and experimental research to analyze how perfumers and trainees acquire sensory skills and how this learning shapes hierarchies within the fragrance industry. The most important experiments involved participant observation in perfumery schools and laboratories, sensory training exercises to document how novices developed olfactory discrimination, and interviews with industry professionals on the social value of expertise. The key results showed that sensory learning in perfumery is not only a technical process but also a social one, where mastery of smell creates distinctions of status, authority, and cultural capital. This research demonstrated that the ability to "smell professionally" functions as both a skill and a marker of social differentiation, highlighting how knowledge, training, and sensory refinement structure power relations within the contemporary perfume world.

Finally, Mustafa (2008), in *The Role of Product Launch Strategy in the Creation of Sales Momentum: The Case of the Fragrance Industry*, conducted empirical experiments through case studies, market analyses, and structured interviews with industry professionals to examine how launch strategies affect the commercial success of perfumes. The most important experiments involved analyzing the timing, positioning, promotional campaigns, and distribution channels of selected fragrance launches, alongside measuring their short- and long-term sales performance. The key results revealed that early momentum is strongly driven by strategic alignment between brand identity, targeted consumer segments, and innovative marketing, while poorly timed or mismatched launches often failed despite product quality. This research demonstrated that in the fragrance industry, a carefully designed product launch strategy is as critical as the scent itself for achieving sustainable market success.

Sustainability and Modern Technology

Iqbal *et al.*, (2025), introduced the Perfume Technology Design (PTD) approach as a groundbreaking method for systematic perfume creation. The most important experiments involved integrating computational chemical engineering tools with sensory evaluation techniques to simulate, predict, and validate fragrance accords before physical formulation. By digitally modeling interactions among key fragrance families and testing optimized combinations through both algorithmic mapping and experimental trials, the researchers were able to reduce trial-and-error in traditional perfumery. The most significant results demonstrated that PTD could generate a wide spectrum of stable and harmonious perfume accords with high reproducibility, significantly decreasing formulation time and material waste. This innovation highlighted the potential of combining digital modeling with experimental validation to transform perfumery from an art largely dependent on intuition into a more efficient, data-driven, and reproducible scientific process.

Likewise, Michailidou (2023), in *The Scent of Change: Sustainable Fragrances through Industrial Biotechnology*, conducted experiments using biotechnological approaches to produce fragrance molecules in a more sustainable way. The most important experiments involved engineering microbial strains and applying fermentation processes to biosynthesize key aroma compounds traditionally sourced from plants or petrochemicals, followed by chemical and sensory analyses to compare quality and yield with conventional methods. The key results showed that microbial fermentation could efficiently generate high-purity fragrance molecules with lower environmental impact, reduced reliance on endangered natural resources, and improved scalability for industrial production. This research demonstrated that industrial biotechnology offers a viable pathway for creating sustainable fragrances while maintaining olfactory quality and commercial competitiveness.

Similarly, Gopi *et al.*, (2023), in *Natural Flavours, Fragrances, and Perfumes: Chemistry, Production, and Sensory Approach*, presented a series of experimental studies focusing on the extraction, characterization, and sensory evaluation of natural aroma compounds. The most important experiments involved applying advanced extraction techniques such as supercritical fluid extraction and microwave-assisted methods to obtain essential oils, followed by chromatographic and spectroscopic analyses to identify their chemical profiles. Sensory panel tests were then conducted to evaluate odor quality, intensity, and consumer preference. The key results showed that optimized green extraction methods enhanced yield and preserved delicate aroma compounds, while chemical-sensory correlations provided a clearer understanding of how molecular composition translates into fragrance perception. This research highlighted the potential of sustainable technologies to improve the efficiency, quality, and reproducibility of natural fragrances and perfumes.

In addition, Rodrigues *et al.*, (2021), explored perfume and flavor engineering from a chemical engineering perspective by conducting experiments that integrated process modeling, separation technologies, and formulation strategies to optimize the design of fragrances and flavors. The most important experiments focused on applying adsorption, distillation, and extraction techniques to isolate and purify key aroma compounds, followed by computational modeling to predict mixture behavior and sensory performance. The key results demonstrated that chemical engineering tools could significantly enhance efficiency in raw material processing, reduce losses of volatile compounds, and improve the reproducibility of complex formulations. This research highlighted that treating perfume and flavor creation as a chemical engineering process transforms it into a more systematic, sustainable, and scalable practice, bridging the gap between traditional artisanal methods and modern industrial production.

Fragrance Families and Raw Materials

About raw materials, there are natural or essential oils extracted from plants, originating from flowers, fruit peels, stems, bark, or roots. They also include components isolated from essential oils, such as citral, limonene, geraniol, and eugenol. The woody group will be represented by oud without a doubt, and because oud has a special audience, especially the Gulf people. oud will have blends that match the value of oud, we will compensate for the woody family with hot woody spices such as cinnamon or cloves or cardamom or nutmeg. Also, because working through 5 families may double the number of accords, for simplification, in the beginning, we will only be dealing with 4 fragrance families. We will put different ratios where the numbers 1, 2, 3, 4, 5 represent the number of drops. For example, A4 means 4 drops of rose and so on, or in another way, the number may represent grams or any unit of measurement suitable for the perfumer (perfume maker) and choose the one that suits you, but the easiest is the dots and the best (Figure 1).

Raw materials were chosen from aroma chemicals, essential oil, or a single compound representing each family. For example, from the floral family, (basil, rose, jasmine, benzyl acetate, or geranium). From the citrus family, (lemon, grapefruit, orange, citral, or linalool). From the fruity family, (Strawberry, Apple, Berries, Coconut, Ethyl maltol, or Aldehydes). And, from the spices, (Cardamom heel, nutmeg, or eugenol). Finally, from the woody family, (natural Oud, Cashmeran, Safranal, or Patchouli) (Teixeira *et al.*, 2014).

Correspondingly, Teixeira *et al.*, (2010), carried out experiments to develop and validate the "Perfumery Radar," a predictive tool designed to classify perfumes into fragrance families based on their chemical composition and sensory attributes. The most important experiments involved compiling a large dataset of essential oils and aroma compounds, characterizing them using physicochemical descriptors and sensory evaluations, and applying multivariate statistical analysis to map their positions within a radar-like model. The key results showed that the perfumery radar could reliably predict and classify perfumes into families such as floral, citrus, woody, and oriental with high accuracy, while also visualizing similarities and differences between complex mixtures. This approach provided a reproducible, quantitative method for perfume classification, bridging sensory perception with chemical composition, and offering a valuable tool for both fragrance design and industrial applications.

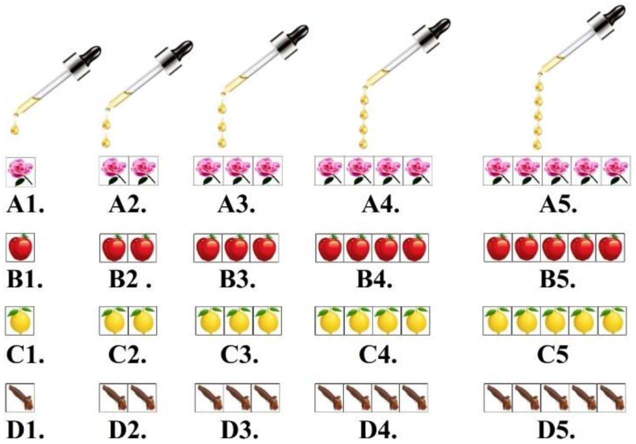


Figure 1: Different ratios represent the number of drops.

Perfume Construction Rules

An accord from one family means an accord consisting of spices or roses or fruits only. For example, A floral accord (Rose + Jasmine + Basil + Geranium + Tulip). Fruit accord (Berry + Apple + Strawberry + Ethyl Maltol + Aldehyde). Spice accord: (Nutmeg + Cloves + Cardamom + Black pepper) (Mossad Hassan, 2025).

There are three perfume construction rules: First, gradation in the proportions of ingredients so that a clashing perfume is not created. Second, identifying is the best for the perfume to have a known identity, i.e., a certain clear direction prevails, even by a small percentage. Third, the mold and decoration which the perfume must have a mold that carries its decoration, and the mold must exceed two-thirds, or 75% of the accord, and the decoration or touch represents the remaining percentage. We give the example of the correct perfume composition with a cake. A mold represented by the cake equals approximately 75%, and the decoration represents approximately 25%. The clearer the perfume is in its identity, the more suitable and attractive it is to humans. The accords resulting from mixing the four fragrance families. We have to note that fruits, sweet and sugary have the same meaning. Is a perfume based on or dominated by roses by more than 75% and has touches of fruit representing approximately 25%, and this is what was studied in the base and ornament rule and the identity of the perfume. We will use the perfume scale, which is the gradation of percentages, using scented paper from the same family but with graded percentages and the numbers indicate the number of drops (Figure 2).

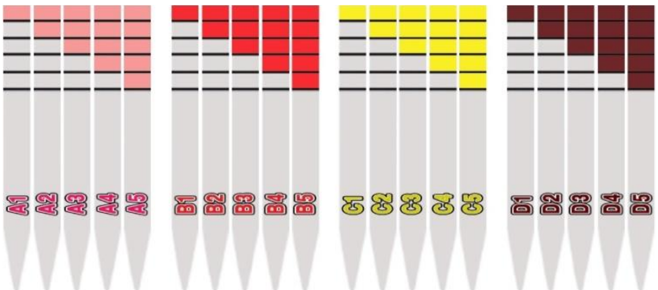
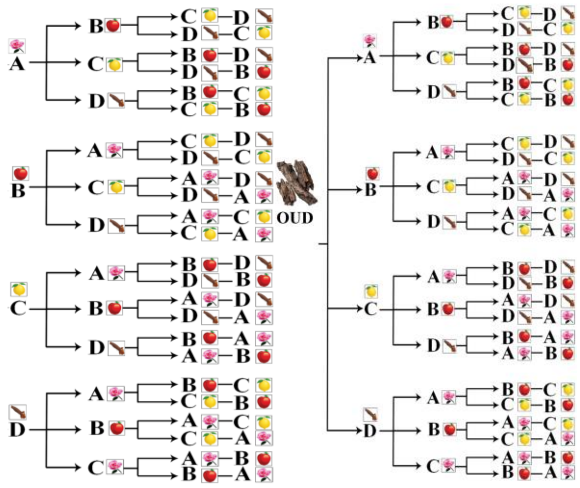


Figure 2: 4 sets of scented papers, each set containing 5 scented papers, in different proportions from the four families the numbers indicate the number of drops.

The result of the possible accords of roses in the aromatic scale in the ratios will be 60 accords. Correspondingly, oud is always used as a mold and is not suitable for decoration. To preserve the direction of oud as a fragrance using the previous results, we can use them all as a decoration for the oud mold. Only we will add oud at a ratio of 60%, 70% on the 60 previous accords, we will thus obtain all the possible combinations of oud in a modern scientific way will be 60 accords, which are described in Figure (3).

Rodrigues *et al.*, (2024), conducted experiments focused on developing computational methods for molecule generation and optimization to enhance fragrance creation. The researchers employed machine learning based generative models combined with quantum chemical calculations to design novel aroma molecules with desirable physicochemical and olfactory properties. The most important experiments involved training algorithms on large fragrance datasets, predicting molecular stability and volatility, and then synthesizing and testing selected candidates to validate computational predictions. The key results demonstrated that this approach successfully produced several new fragrance molecules with optimized scent profiles, improved stability, and reduced environmental impact compared to traditional synthetic routes. Overall, the study proved that computational molecule generation and optimization can significantly accelerate the discovery of innovative fragrance ingredients, reducing reliance on costly trial-and-error experimentation.



(A) (B)

Figure (3): (A) Possible outcomes of 60 Accords of roses, and (B) 60 Accords of roses in the aromatic scale.

Perfume Design Map

The experience of creating about 1187 accords using litmus paper. Forming 4 groups of scented paper, each group containing 5 papers, With different proportions of the four families. Thus, we get 150 accords with (30 repeated) from mixing 2 families, 500accords with (40 repeated) from mixing 3 families, and 625 accords with (18 repeated) from mixing 4 families as shown in Figure (2). Total output, 150 accords with 30 duplicate results, such as C1B1 is the same performance as C2B2, and A2B4 equal A1B2, and for simplicity, we will ignore the duplicate results. So, the output will be 120, not 150, from mixing 4 different types of aromatic families in ratios of 1:5. And it is clear from the result that the number of accords or Formulas is 500, including 40 duplicate results, so, we may reach some similar results with different numbers but with few settings that can be ignored, such as A2C1B1 is similar to A4C2B2. Accord results consisting of 4 aromatic families A, B, C, D in ratios of 1:5, resulting in 625 formulas. Among them are 18 duplicate results. So, we will take the resulting accords from mixing B, C, and D, and add A to them like this: A2B1C1 is the same result as A4B2C2, and A4B4C2 is the same result as A2B2C1, which are simple numbers that can be ignored as described in Figures (4 & 5).

Ellena (2011), in Perfume: *The Alchemy of Scent*, combined reflective experimentation with practical demonstrations to reveal the creative and technical processes behind modern perfumery. The most important experiments involved systematically blending raw materials to illustrate how different proportions of natural extracts and synthetic molecules generate unique accords, as well as testing the sensory impact of minimalistic versus complex compositions. The key results showed that perfume creation relies on both scientific precision and artistic intuition, where balance, clarity, and simplicity often yield more powerful olfactory effects than overcomplicated mixtures. Ellena's work demonstrated that perfumery is an "alchemy" in which chemistry and imagination converge, offering insights into the reproducible yet deeply personal art of scent design.

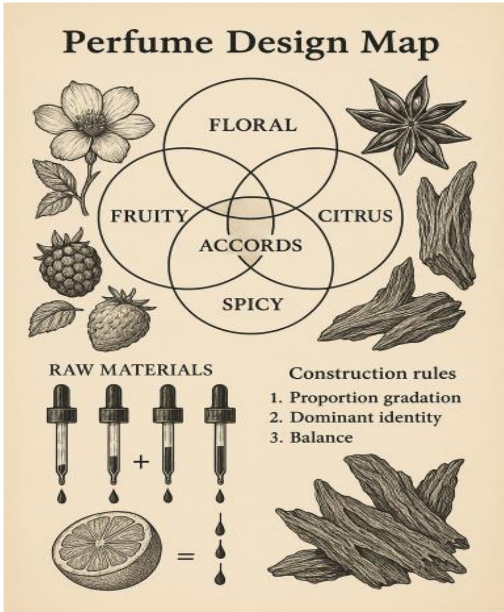


Figure 4: Schematic illustration for the perfume design map.

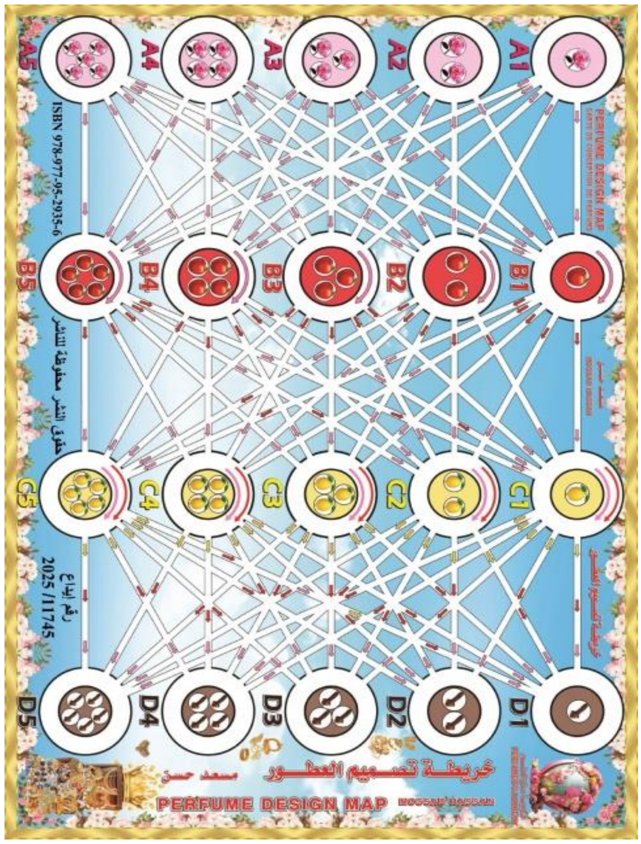


Figure 5: The Perfume Design Map, showing how four main fragrance families can be systematically combined to generate hundreds of unique accords, ultimately leading to innovative and reproducible perfume formulations.

Based on the Perfume Design Map, here's an idea for a Smart Perfume Designer Program that uses statistics, probability, and optimization to generate countless perfume formulas by mixing 4 perfume types from a library of A, B, C, D fragrance groups in different proportions. "Perfumer" is an application allows the user to select each perfume attributes (floral, fruity, woody, spicy, etc.). Statistical mixing engine uses probability distributions (e.g., Dirichlet or multinomial distributions) to randomly generate mixtures of 4 perfumes whose proportions always sum to 100%. The program scores each formula using weighted probability models such probability of balance to avoiding dominance of one scent, compatibility score by using a matrix of which groups blend harmoniously, novelty score for how unique product compared to existing perfumes, and Artificial Intelligence/Machin Learning (AI/ML) models can be trained on perfume databases to predict likelihood of consumer preference. The app uses statistical optimization (e.g., genetic algorithms or Bayesian optimization) to find the best formulas matching the user's target scent profile. Likewise, the app provides formula recipes as percentages of each perfume, graphical "Perfume Wheel" visualization, probability distribution of scent families in each formula, and option to export results as lab-ready mixing instructions. Finally, extra feature, users can simulate market trends by applying probability weights based on popularity of certain scents. In short, this app combines probability, statistics, and optimization to act as an AI perfume designer, generating infinite variations of 4 perfume blends with scientific precision (Mossad Hassan, 2025) as revealed in Figure (6).

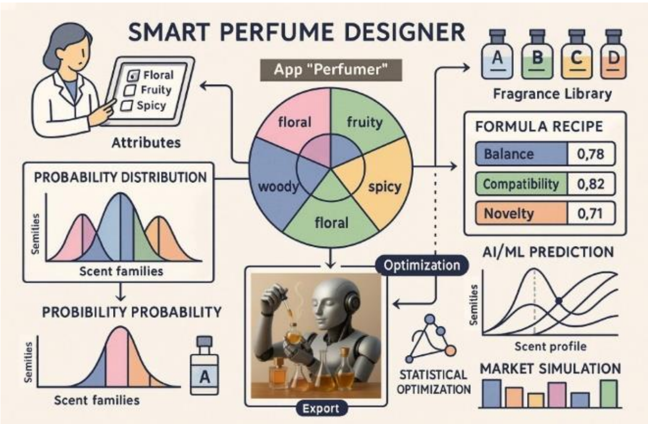


Figure 6: A Special Idea for a Smart Perfume Designer Program "Perfumer" Application

Modern Advances and Applications

Modern methods extend beyond traditional mixing such as the computational modeling (Iqbal 2025 and Rodrigues 2024) predicts and optimizes accords digitally. And, biotechnology and green extraction (Michailidou 2023 and Gopi 2023) produce sustainable aroma molecules. Whereas, cross model design (Pimentel 2025 and Spence 2024) links scent with soundscapes for marketing and art. Finally, the industry networks and innovation (Kubartz 2009 and Islam 2016) highlight the social and creative dimensions of perfumery.

Wang *et al.*, (2024), developed and evaluated borneol-modified lipid nanoparticles (BO-LNPs) as a nasal spray formulation to enhance nose-to-brain drug delivery for central nervous system (CNS) diseases. The researchers conducted a series of experiments, including physicochemical characterization of the nanoparticles, in vitro assessments of cellular uptake and permeability across nasal epithelial cells, and in vivo biodistribution studies in animal models. The results demonstrated that BO-LNPs exhibited high stability, optimal particle size, and efficient drug encapsulation, while borneol modification significantly improved penetration through nasal mucosa and increased transcellular transport. In vivo imaging and pharmacokinetic analyses confirmed enhanced drug accumulation in brain tissues compared with non-modified LNPs, highlighting the ability of borneol to facilitate direct olfactory and trigeminal nerve-mediated transport. Collectively, the findings indicate that borneol-modified lipid nanoparticles represent a promising non-invasive strategy for improving therapeutic delivery to the brain via intranasal administration.

Also, Du *et al.*, (2024), reviewed recent advances in nanomedicine-based oral and intranasal aerosol drug delivery, focusing on experimental strategies that enhance drug absorption, stability, and targeting to the respiratory and central nervous systems. The paper highlighted key studies where nanoparticles, liposomes, polymeric carriers, and lipid-based systems were engineered to improve mucosal adhesion, overcome enzymatic degradation, and achieve controlled release. Experimental evidence discussed showed that aerosolized nanocarriers significantly increased drug bioavailability, enabled efficient nose-to-brain transport, and improved therapeutic outcomes in models of respiratory infections, neurodegenerative diseases, and systemic disorders. Importantly, results from in vitro mucosal penetration assays and in vivo animal studies consistently demonstrated superior delivery efficiency and reduced systemic side effects compared to conventional formulations, underscoring the clinical potential of nanomedicine for non-invasive aerosol therapies (Figure 7).

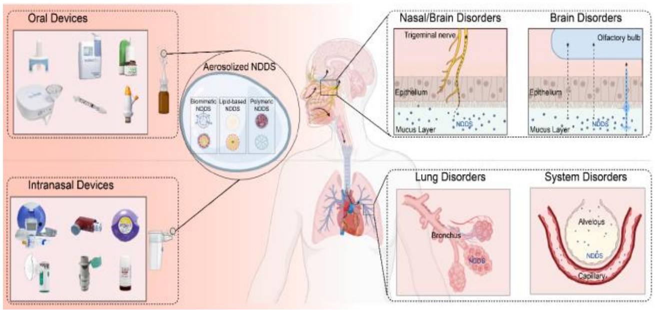


Figure 7: Breath and beyond: advances in nanomedicine for oral and intranasal aerosol drug delivery.

Likewise, Gandhi *et al.*, (2024), investigated the potential of nanoparticle-based systems for enhancing nasal-to-brain drug delivery, focusing on experimental studies that evaluate formulation properties, transport mechanisms, and therapeutic outcomes. The researchers summarized evidence from in vitro cell culture models, ex vivo nasal mucosa permeation studies, and in vivo animal experiments demonstrating that nanoparticles such as polymeric carriers, solid lipid nanoparticles, and nanostructured lipid carriers significantly improve drug retention in the nasal cavity, facilitate transport via olfactory and trigeminal pathways, and increase brain bioavailability compared to conventional formulations. Key results showed that optimized nanoparticle systems not only enhanced drug solubility and stability but also reduced systemic exposure and side effects, highlighting their promise for treating central nervous system disorders through non-invasive intranasal administration.

In addition, Wang *et al.*, (2020), designed and evaluated a novel nano-fragrance delivery system with pH-sensitive release properties aimed at improving central nervous system (CNS) function. The researchers prepared fragrance-loaded nanoparticles and conducted physicochemical characterization to confirm suitable particle size, stability, and encapsulation efficiency. In vitro release experiments demonstrated that the system exhibited controlled and accelerated fragrance release under acidic conditions, mimicking physiological environments. In vivo studies in animal models further revealed that inhalation of the nano-fragrance enhanced cognitive performance and alleviated CNS dysfunction compared with free fragrance administration, indicating improved bioavailability and sustained effect. Overall, the experiments confirmed that the pH-responsive nano-fragrance system offers a promising strategy for controlled intranasal delivery to support CNS health.

Correspondingly, Kaul *et al.*, (2018), reviewed recent experimental advances in the application of nanotechnology to cosmeceuticals, emphasizing studies on nanoparticles such as liposomes, solid lipid nanoparticles, nanoemulsions, and dendrimers for skin care and dermatological applications. The reported experiments demonstrated that these nanosystems improved the solubility, stability, and controlled release of active cosmetic ingredients while enhancing their penetration through the skin barrier. In vitro and in vivo studies highlighted increased bioavailability, prolonged retention time, and targeted delivery of antioxidants, vitamins, sunscreens, and anti-aging agents, resulting in superior efficacy compared to conventional formulations. The findings underscored the critical role of nanotechnology in developing safer, more effective cosmeceutical products with enhanced therapeutic and aesthetic benefits.

CONCLUSION

In conclusion, this research successfully introduced a structured scientific framework for perfume design. By combining a limited number of raw materials from key fragrance families, a vast number of harmonious accords can be created systematically. The perfume design map bridges art and science, enabling reproducibility, innovation, and efficiency in fragrance formulation. Establishing clear construction rules and validating the role of dominant vs. decorative notes marks a step toward a third era of perfumery where scents are deliberately designed to influence psyche, behavior, and emotion, while also offering practical tools for perfumers and researchers worldwide.

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