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Growing Inclusivity: The Principles of Universal Plant Selection

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Abstract

This article establishes a practical framework for applying universal design principles to the selection and integration of plants, positioning horticulture as essential, health-promoting infrastructure. It argues that moving beyond aesthetic criteria to consider the full human experience is fundamental for creating equitable landscapes where the documented biophilic benefits of nature—spanning psychological, cognitive, physical, and social wellbeing—are universally accessible.

The proposed framework provides actionable, evidence-based guidance. It details critical selection principles addressing foundational safety (toxicity, allergens, sightlines), holistic sensory engagement across all modalities, and temporal dynamics like year-round seasonal interest. It further explains how planting can provide essential microclimatic and navigational functions, including shade, shelter, acoustic buffering, and wayfinding.

Each principle is analysed through the lens of primary user groups—including children, older adults, wheelchair users, and neurodivergent individuals—demonstrating how plant choice directly impacts accessibility, comfort, and independent use. The discussion connects strategic initial selection to long-term maintainability and cultural-ecological fit, ensuring spaces are sustainable, meaningful,

and resilient. This integrated approach empowers designers and planners to create inclusive environments where the restorative power of nature is a shared resource, actively cultivating equity, connection, and wellbeing for all.

Keywords:

***Universal Design; Inclusive Landscapes; Plant Selection; Accessibility; Sensory Design; Biophilia; User-Centered Design*.**

Introduction

The human connection to nature, or biophilia, is supported by extensive research. Integrating plants into our environments provides significant psychological, cognitive and physical benefits. This evidence establishes plants as essential infrastructure for human health, not mere decoration.

Exposure to nature reduces stress, anxiety and depression while improving mood and energy levels. Visual access to greenery can lower blood pressure and heart rate. Cognitive benefits include improved focus, creativity and academic performance (Stone, 2022; Augustin, 2023). For children, access to green spaces is linked to better attention spans (Kuo & Taylor, 2004).

These benefits are rooted in multi-sensory engagement. Biophilic design creates opportunities for sensory interaction. Views of nature lower physiological stress (Ulrich, 1984). Natural sounds like birdsong promote psychological restoration faster than urban noise (Alvarsson et al., 2010). Scents from plants can evoke positive memories, while tactile interaction promotes relaxation.

Plants also deliver direct physical health benefits by improving environmental quality. They act as natural bio-filters, removing pollutants like carbon dioxide and volatile organic compounds from the air (Smith, 2023). This is critical indoors, where air quality directly impacts cognitive performance. Plants can absorb toxins from building materials and increase oxygen levels (Smith, 2024). Living walls amplify this air-purifying capacity and can reduce noise pollution (Hutson & Hutson, 2024).

Vegetation also mitigates urban heat through shade and evapotranspiration. Living walls act as thermal buffers, reducing building cooling and heating needs (Sabin, 2023). Urban tree canopies save lives by reducing heat stress (O'Ceallaigh, 2023). Foliage also absorbs and deflects sound waves, buffering traffic noise in workplaces and residential areas (Palfreyman, 2024).

The therapeutic impact is clear in clinical settings. Roger Ulrich's seminal 1984 study found patients with a view of trees recovered faster and required less pain medication. This biophilic effect is now central to healthcare design, with therapeutic spaces shown to reduce stress for patients and families (Ulrich et al., 2020).

Socially, accessible green spaces strengthen community bonds and promote mental well-being (Wang et al., 2019). They serve as vital social infrastructure. Community gardening builds togetherness, while thoughtfully designed spaces can mitigate collective urban stress (Shepley & Sachs, 2023).

In summary, the benefits of plants are holistic, intersecting psychological, cognitive, physiological and social domains. This understanding elevates plant selection from an aesthetic concern to a core component of public health and universal design.

Integrating Plants into Lived Environments

The benefits of plants are activated by their intentional integration into daily environments, from public parks to interior spaces.

Beyond large parks, green infrastructure is deployed creatively across the urban matrix. Biodiverse tree canopies in streetscapes filter air, provide shade and buffer traffic. Green roofs offer insulation, manage stormwater and provide restorative views. In dense areas, living walls and green façades improve air quality, dampen noise and support urban biodiversity. Balconies become private oases and micro-corridors for wildlife.

Purpose-built sensory or therapeutic spaces in hospitals, schools and care settings use curated planting to reduce stress, aid memory and facilitate therapy.

The biophilic imperative extends indoors, where people spend most of their time. Here, plants address specific environmental and psychological needs.

In workplaces, plants are linked to improved mental health, creativity and productivity (Smith, 2024). They purify air of office pollutants and provide visual respite. Effective office plants include Philodendron, Aglaonema, Dracaena and Spathiphyllum (Smith, 2023). Areca palms release moisture and reduce dust, while Dracaena varieties remove chemical toxins (Bell, 2023).

In healthcare design, plants and nature views reduce patient pain and anxiety. Selection focuses on therapeutic goals, using plants like Monstera for engaging foliage or Soleirolia for calming texture. Practicalities are key, such as avoiding spore-producing ferns where sterile air is needed (Bell, 2023).

In educational settings, plants lower student stress and improve concentration. Easy-care, non-toxic plants like Golden Pothos, which remove chemical vapours, are ideal. Some plants, like the ZZ plant, can reduce CO_2 levels at night (Bell, 2023).

In residential and care settings, plants create calming atmospheres. For older adults or those with dementia, non-toxic, tactile plants stimulate senses and trigger memories. Raised planters ensure access for those with limited mobility, supporting emotional well-being (Yeo et al., 2020).

Plants are now essential, functional infrastructure for health, seamlessly integrated from public parks to interior spaces.

Why Accessibility and Universal Design Matter

The benefits of plants are universal, but access is not. Universal design creates environments usable by all people without adaptation, making it an ethical imperative.

A fundamental barrier exists between people and nature. For individuals with disabilities, older adults or parents with young children, obstacles like inaccessible pathways or lack of seating make green spaces an exclusive privilege. Accessible urban greenery is essential for well-being, recreation and social inclusion, supporting the human rights of people with disabilities (Pineda & Corburn, 2020). Universal design principles create spaces that are both physically navigable and socially equitable (Selanon & Chuangchai, 2024).

These benefits are often most needed where mobility is challenged. A tree visible from a hospital window delivers proven therapeutic advantages. In schools and offices, plants improve concentration

and satisfaction for all (Dravigne et al., 2008). For a child with ADHD, time in accessible green space can reduce symptoms significantly (Faber Taylor & Kuo, 2009). Without inclusive design, this potential remains untapped.

True universal design also embraces emotional, sensory and cognitive inclusion. A space must be not only reachable but resonant. This involves using nature's rhythms, textures and calming essence to foster safety and belonging. For neurodivergent individuals, it balances sensory stimulation with quiet refuges. For a person with vision loss, it prioritises auditory, tactile and olfactory cues. For someone with hearing impairment, it uses clear visual landmarks. This holistic philosophy ensures spaces are restorative for every user.

In conclusion, universal design in plant selection is the critical link between the existence of green space and the realisation of its benefits for everyone. It ensures these advantages are shared resources, nurturing difference through connection with nature.

Plant Selection Principles for Universal Design

Integrating plants into our environments holds great potential for enhancing wellbeing. To ensure these benefits are universally accessible, plant selection must be guided by principles that go beyond aesthetics. Universal design in horticulture requires seeing plants as dynamic, multi-sensory components of the living environment. Every choice carries implications for safety, sensory experience, accessibility and long-term usability.

This approach begins with appreciating the plant as a complete sensory entity. Effective design requires analysing all parts: its

overarching form, bark texture, twigs, buds, seasonal flowers, leaves, fruit and even root architecture (Tyznik, 1981). These elements collectively determine a plant's contribution in terms of line, form, texture, colour and density. The value of gnarled bark or vivid autumn foliage (Alabi, 2021) is not just visual beauty; it is potential sensory information and emotional trigger points for diverse users.

Plant selection for universal design is therefore an exercise in thoughtful balance. It harmonises visual interest with practical necessities like clear sightlines. It deliberately integrates diverse tactile elements—from hard barks to soft leaves—to provide sensory input that can stimulate or calm, a key consideration for neurodivergent individuals. It also demands anticipating how a plant will evolve through seasons and decades, and how its lifecycle impacts those who engage with it.

The following principles shift the fundamental question from the purely horticultural "what grows here?" to the human-centric: "Who is this for? How will they experience it?"

Principle 1. Seasonal Selection

In universal design, time is a critical consideration. A planting scheme that offers engagement for only a few months fails the principle of equitable use. Seasonal selection is a commitment to providing consistent, year-round access to nature's benefits.

A thoughtfully composed seasonal palette serves multiple purposes. For individuals with neuro-cognitive disorders like dementia, the changing landscape provides non-verbal markers of time's passage, reducing disorientation by grounding them in natural rhythms

(Delhanty, 2017). In educational settings, a garden that progresses through the seasons becomes an immersive classroom for learning about natural cycles.

As Tyznik (1981) outlines, each season highlights different attributes: structural form in winter, floral displays in spring, cooling greens in summer, and dramatic foliage in autumn. This progression actively prevents sensory monotony. By prioritising plants with multi-season interest and placing them within key views, the evolving spectacle remains accessible to those with limited mobility.

Designing for a sequence of interest means selecting species so that as one plant's display fades, another's begins. It requires looking beyond flowers to winter berries, ornamental grasses, trees with coloured bark, and persistent seed heads. By making seasonal variety a primary criterion (Finnigan, 2023), designers create landscapes that are truly engaging every day of the year.

Principle 2. Time and Growth Considerations

Universal design requires a forward-looking perspective that accounts for plants' dynamic nature. Considering temporal scales—from immediate engagement to long-term maturation—is essential for spaces to remain safe, functional and beautiful.

For some user groups, including children or those new to gardening, the slow pace of traditional horticulture can be disengaging. Incorporating fast-growing plants like annuals or sunflowers provides quick, visible results that sustain interest and reward participation (Gaudion & McGinley, 2012). This fosters an immediate sense of accomplishment.

A truly universal design must also plan for the mature size, form and habit of every plant. Failure to do so can compromise accessibility and safety: trees may block crucial sightlines or paths; shrubs can obstruct wheelchair access; root systems may heave paving, creating tripping hazards (Yazici et al., 2018; Atabeyoğlu et al., 2014). Designers must ask what a plant will look like in 5, 10, or 25 years, and whether its growth will alter the sensory quality or safety of the space.

Principle 3. Safety Considerations

At the heart of universal design is safe and equitable use. Risk minimization through informed plant choice is essential, particularly for vulnerable groups like children, the elderly, or those with sensory differences.

A. Inherent Toxicity and Texture

The most direct safety intervention is selecting species with benign properties. Avoid plants with toxic parts in areas where they may be touched or ingested, such as spaces for children or individuals with dementia. Plants like daffodils, rhododendron and yew pose serious risks (Beckwith & Gilster, 1996; Alzheimer's WA, 2020). Use only pesticide-free soil and non-toxic materials.

Plants with thorns, spines or sharply textured leaves, such as roses or cacti, should be avoided in reachable areas along pathways and seating zones. If used for security, they must be placed well away from public contact.

While supporting pollinators is important, dense concentrations of nectar-rich flowers should not be placed directly next to

playgrounds, entrances or narrow walkways. Position them in less frequented zones to support biodiversity without creating risks.

B. Sightlines: Balancing Enclosure and Visibility

Strategic management of sightlines is crucial for physical and perceived safety. People feel safer with clear, unobstructed views. Planting should favour taller trees with high, open canopies, while keeping the understory clear. Studies indicate this improves visibility and correlates with higher perceived safety (Mouratidis, 2019). This approach is especially recommended in therapeutic gardens and schools, where caregiver sightlines are essential (Yazici et al., 2018).

Near roads and crossings, low planting or high-canopy trees with trimmed branches are preferable to dense mid-level shrubs that obscure sightlines. Designs should aim for partially open layouts, using vegetation to define spaces without creating visual isolation (Baran et al., 2018).

The synergy between thoughtful design and consistent upkeep is critical. Well-pruned vegetation projects care and safety, while neglected landscapes provoke unease.

C. Allergies: Mitigating Pollen and Irritants

Universal design must address physiological sensitivities. With around 30% of the global population affected by pollen allergies, plant selection is a public health consideration (Pawankar, 2014).

Prioritise low-allergenic, insect-pollinated plants over wind-pollinated species. Wind-pollinated plants like Birch, Oak, Maple and many grasses release vast amounts of airborne pollen (National Asthma Council Australia, 2024). Insect-pollinated plants, like most

showy flowering perennials, produce heavier, stickier pollen that poses a much lower risk.

Consult local asthma and allergy organisation guides for tailored lists of low-allergenic species. Avoid planting high-pollen trees near building air intakes, open windows, seating areas or playgrounds. Some plants, like the London Plane tree, shed irritants and should be avoided in public, interactive spaces.

Creating an allergy-aware landscape is about informed, strategic substitutions. By choosing insect-pollinated, low-pollen alternatives and considering placement carefully, designers ensure green spaces are accessible to the widest audience, including those managing allergies and asthma.

Principle 4. Privacy and Shelter

After addressing safety, universal design supports psychological comfort and personal agency. Privacy and shelter, achieved through strategic planting, help users feel secure and in control. Plants can define boundaries, buffer environmental stressors and create intimate refuges, which is particularly valuable for neurodivergent individuals, children, the elderly and anyone needing respite.

The human desire for refuge—a sheltered spot to observe without being in full view—is a biophilic design foundation. Hedges, dense shrubs and overarching tree canopies softly define territory, establish visual privacy and create quiet zones. A bench nestled beneath a tree or within a semi-enclosed nook provides a crucial "retreat and reflect" space.

Shelter extends beyond visual privacy to physical protection. Effective windbreaks require dense, multi-layered planting from the ground up, as low hedging alone is often insufficient. Proper vegetative buffers reduce wind speed and associated noise, addressing a significant issue for sensory-sensitive users (Xu, 2023).

Planting also acts as a living buffer against intrusive noise and undesirable views. A well-designed strip of vegetation between a pathway and a roadway creates vital physical and psychological separation, enhancing the walking experience.

For neurodivergent individuals, the ability to self-regulate is crucial. Escape spaces—clearly defined, quiet areas—should offer enclosure without isolation. Designs might use translucent elements like willow dens or bamboo screens to create separation while maintaining visual connection for safety (Gaudion & McGinley, 2012). The goal is to offer choice and control.

Planting should create a gradient of spaces, from open and social to semi-private and sheltered. This allows users to select their preferred level of engagement. Successful design ensures these spaces are inviting, legible and safe, using plants as tools for empowerment within the shared landscape.

Principle 5. Shade

Shade is fundamental for comfort, accessibility and public health. In universal design, effective shade is a necessity for equitable use, protecting users from UV radiation, reducing heat stress and creating comfortable microclimates. Strategic shade creation

through planting must be intentional, as not all vegetation provides meaningful protection.

Adequate shade safeguards vulnerable populations, including children, the elderly and individuals with increased photosensitivity (Delhanty, 2017). Without it, outdoor areas can become unusable during sunny hours. Shade also supports thermal regulation benefits, making outdoor engagement viable during warmer months.

A common design pitfall is conflating greenery with functional shade. Low shrubs and ground cover provide negligible protection (Xu, 2023). Effective solar protection requires considering plant form and placement.

For shaded corridors along pedestrian routes, utilise tall trees with broad, dense canopies. These create a high, leafy ceiling that filters intense summer sun while allowing air circulation at ground level.

Over seating areas, pergolas with climbing vines or trees with lighter foliage create dappled, softer light. This reduces glare and heat without creating enclosure, making spaces more inviting for socialising (Delhanty, 2017).

Shade is essential for sheltered refuges. A seating area achieves full restorative potential when under a mature tree's canopy. Shaded canopies at building entrances also moderate abrupt visual and thermal shifts between exterior and interior, reducing disorientation and anxiety.

Shade provision should be program-driven. Designers must identify where people walk, wait or linger, and map shade as deliberately as pathways. This ensures outdoor comfort and protection are fully and equitably accessible.

Principle 6. Wildlife Attraction

A truly universal environment recognises that human wellbeing intertwines with ecosystem health. Prioritising plants that attract wildlife serves a dual purpose: enhancing biodiversity and creating dynamic, multi-sensory experiences for people. This interaction provides educational, therapeutic and emotional benefits.

Selecting native, nectar-rich, berry-producing and host plants sustains local food webs and biodiversity. In urban environments, gardens serve as stepping stones for wildlife movement. Features like mature trees, dense shrubs and seasonally blooming flowers create critical stopover points. Even living walls can become micro-habitats, offering shelter and food (Sabin, 2023).

Wildlife transforms a static garden into living theatre. The flash of a butterfly's wing, the hum of bees and birdsong add captivating sensory layers. In therapeutic environments like dementia care gardens, wildlife can spark curiosity, stimulate conversation and support memory recall.

For children, a garden teeming with life is a powerful outdoor classroom, making ecological learning tangible and engaging. Spontaneous wildlife encounters can elicit joy, wonder and peace, deepening the restorative experience.

While attracting wildlife is desirable, it must be managed thoughtfully. Plants that attract stinging insects should be placed in peripheral beds or designated pollinator gardens, not immediately adjacent to high-traffic playgrounds or entryways.

The goal is to create a shared habitat. Plant selection should contribute to local ecology while enabling safe, delightful human-

wildlife interaction, creating richer environments that benefit all species.

Principle 7. Wayfinding and Rhythm

A universally designed landscape must be legible and predictable, allowing intuitive navigation. Wayfinding is influenced by visual and sensory patterns created by planting. Rhythm and repetition can provide comforting order and clear guidance, but can also cause sensory distress if misapplied.

Rhythmic planting applies visual perception principles to aid navigation. The Gestalt principle of Continuation suggests aligned elements are perceived as a continuous group. An alley of evenly spaced trees creates a strong visual line guiding movement along a path, helpful for individuals with hearing impairments who rely on visual cues (Yazici et al., 2018).

Similarly, the principle of Similarity creates intuitive navigational cues. A distinct landmark—like a tree with a unique silhouette or a cluster of fragrant shrubs—against a uniform backdrop naturally stands out, signalling key locations like decision points or entries.

True universal wayfinding engages multiple senses. For individuals with visual impairments or dementia, other senses become primary navigational tools. Strongly scented plants like rosemary or lavender at key junctions create unmistakable sensory markers that can trigger memory and aid orientation. Dense hedges or buffer planters define zones, preventing disorientation by making layouts more comprehensible (Xu, 2023).

However, rhythm misapplied poses serious sensory hazards. The flicker effect occurs when evenly spaced vertical elements are

viewed from a moving vehicle or by walking individuals with visual sensitivities. This rapid strobing of light and shadow can trigger sensory overload, dizziness or seizures in susceptible individuals (Finnigan, 2023). Therefore, avoid simple monotonous repetition along high-speed routes. Break patterns with varied spacing, grouped plants or different species and heights.

Planting should create a hierarchy of cues. Use rhythmic, repetitive planting for guiding corridors where predictability helps. Then intentionally introduce sensory "events"—a unique tree, a scent garden, a textural change—to mark key locations. Always evaluate rhythmic patterns from the user's perspective in motion to eliminate dangerous flicker effects, creating landscapes respectful of neurological diversity.

Principle 8. Sensory Support Through Plant Selection

The principles of universal design find profound expression in thoughtful sensory engagement. Plants deliver rich, multi-sensory experiences that can calm, stimulate, orient and heal. For individuals with dementia or neurodivergent individuals with distinct sensory processing styles, a well-designed sensory landscape can mean the difference between exclusion and connection. Therefore, curating sensory experiences is a cornerstone of inclusive design.

A holistic approach involves two parallel strategies: providing stimulating, accessible sensory input and preventing harmful sensory overload.

Effective sensory areas are not uniformly stimulating. They are carefully zoned:

- **Alerting Zones: Areas with brighter colours, stronger scents and dynamic elements to engage and energise.**
- **Calming Zones: Areas with soft textures, muted colours and gentle sounds to promote relaxation.**
- **Transition Spaces: Neutral areas with minimal sensory input, allowing users to decompress between zones.**

This zoning creates choice and control, balancing stimulating 'sensory spaces' with quiet 'escape spaces'—a critical consideration for preventing overwhelm (Fors et al., 2026; Kinnaer et al., 2016).

Sensory design must accommodate both hyper-sensitive and hypo-sensitive users (Gaudion & McGinley, 2012).

- **For those easily overstimulated, design should employ gradual introductions of stimuli, group similar textures and manage scent intensity carefully.**
- **For those who seek sensory input, design should offer a varied mix of textures, touch-reactive plants, bold colour contrasts and diverse tactile and auditory experiences.**

Equally important is avoiding sensory triggers that cause distress. For a universally accessible garden, common triggers must be managed (Sustainable Gardening Australia, 2025; Mostafa, 2021). These include overpowering smells, jarring sounds, unpleasant tactile textures, visually chaotic patterns and dangerous flickering light effects.

The following sections explore how to harness each specific sense through plant selection and placement.

A. Sight/Visual

Vision is a primary sense, but visual perception varies dramatically. Universal design for sight must address a spectrum, from creating high-contrast environments for those with low vision to managing colour intensity for the visually hypersensitive.

Colour theory is a practical tool. Bright, warm colours (red, orange, yellow) are more easily detected by individuals with low vision, as cooler tones like blue can appear muted (Polat et al., 2017; Souter-Brown, 2015). Using these warm, saturated colours for key focal points creates high-contrast visual cues for navigation. Warm colours appear to advance, making spaces feel intimate, while cool colours recede, creating an illusion of depth (Gray, 1999).

Colour also influences psychological state. Alerting zones benefit from energising warm palettes, while calming zones should employ muted tones and cool colours to promote tranquility (Wagenfeld, 2025; Sustainable Gardening Australia, 2025).

Beyond colour, other visual characteristics aid legibility. Creating strong visual contrast—such as light foliage against a dark wall—defines edges and shapes. For individuals with partial sight, a plant's clear silhouette often provides more crucial navigational information than fine details.

Employing plants with varied sizes, shapes and textures builds a rich visual tapestry. To sustain interest, incorporate a mix that ensures

succession of bloom, foliage colour and structural form across all seasons.

Visual details must be placed where they can be seen. For wheelchair users or those with a stooped posture, intricate textures and colours should be featured at or below eye level. Raised planters, hanging baskets and low-growing, colourful ground covers are excellent for this (Polat et al., 2017; Yazici et al., 2018).

Universal design avoids overly bright, clashing colour patterns and unpredictable, fast-moving shadows, which can cause visual chaos and overstimulation.

Plants (examples)

- **High-Contrast Blooms: Sunflower (*Helianthus annuus*), Zinnia (*Zinnia elegans*), Snapdragon (*Antirrhinum majus*), Purple Coneflower (*Echinacea purpurea*), Geranium (*Pelargonium*)**
- **Seasonal Interest – Spring: Crocus, Tulip, Flowering Dogwood (*Cornus florida*), Magnolia**
- **Seasonal Interest – Summer: Phlox, Bellflower (*Campanula*), Yarrow (*Achillea*)**
- **Seasonal Interest – Autumn: Fothergilla, Serviceberry (*Amelanchier*), Smokebush (*Cotinus coggygria*)**
- **Seasonal Interest – Winter: Red-twig Dogwood (*Cornus sericea*)**
- **Foliage Interest: Coral Bells (*Heuchera*), Fountain Grass (*Pennisetum*)**

B.Sound/Auditory

The acoustic environment is a powerful, yet often under-designed, layer of sensory experience. Universal acoustic design has a dual objective: to introduce pleasant natural sounds and to mitigate unpleasant external noise.

Intentional planting creates a tapestry of desired sounds. Species with specific structural qualities produce characteristic noises. Ornamental grasses, bamboo and trees with large leaves create a soothing rustle in the wind, providing gentle auditory stimulation (Kopeva et al., 2020). Dried seed pods add subtle rattling textures.

A primary source of pleasant sound is wildlife. By planting nectar-rich flowers and berry-producing shrubs, a garden attracts birds and insects, whose songs and hums create a vibrant soundscape that enhances mood and supports focus.

A key function is to buffer intrusive noise from traffic or machinery. Dense, multi-layered plantings of trees, shrubs and groundcover act as effective living sound barriers. Evergreen hedges and living walls provide consistent, year-round acoustic buffering, fundamental to creating the "quiet refuge areas" necessary for sound-sensitive individuals.

An inclusive soundscape also considers those with limited or no hearing. Sound should be paired with complementary visual and tactile-vibrational cues.

Design the auditory environment with intention. Use peripheral plantings as acoustic buffers to shield calm zones. Within those zones, orchestrate natural sounds through strategic plant selection. Always ensure key auditory information is not masked, and provide

visual or tactile alternatives. The goal is a balanced soundscape where nature's sounds are pleasant and outside noise is softened.

Plants (examples)

- **Rustling: Ornamental Grasses (*Miscanthus*, *Calamagrostis*), Clumping Bamboo**
- **Rattling/Popping: False Indigo (*Baptisia australis*) pods, Balloon Flower (*Platycodon grandiflorus*) buds**

C. Smell/Olfactory

The sense of smell has a direct pathway to the brain's limbic system, the centre of emotion and memory. This makes scent a potent tool in planting design. For individuals with dementia or low vision, fragrant plants can provide unparalleled cues for orientation and trigger reminiscence. However, scent is subjective and can easily overwhelm, making its management critical. The goal is to offer gentle, pleasurable and controllable olfactory experiences.

Scented plants serve several key functions. Strategically placing a fragrant plant like rosemary at a path junction creates a distinct, non-visual wayfinding cue. Familiar scents from herbs or flowers can trigger personal memories and reduce anxiety. Scents also shape emotional quality; lavender can define a restorative zone, while citrus may energise an active area.

Because sensitivity varies, design must prioritise user control. Make scent optional by using plants that release fragrance only when touched, such as lemon verbena. Establish scent-free zones in quiet

seating areas where the air is clear of strong aromas (Wagenfeld, 2025; Gaudion & McGinley, 2012).

For those who enjoy scent, plant fragrant species along pathways, near seating and at nose-level in raised beds. However, some scents can trigger asthma or migraines. Plants with pungent odours should be used sparingly and placed away from seating (Xu, 2023).

Treat scent as a delicate seasoning. Zone fragrances deliberately—concentrate them in specific areas and ensure clear, scent-free refuges are available. Prioritise gentle, familiar and non-allergenic scents, giving users the choice to engage with or retreat from fragrance.

Plants (examples)

- **Floral/Sweet: Viburnum (*Viburnum carlesii*), Phlox, Sweet Autumn Clematis (*Clematis terniflora*)**
- **Herbal/Fresh: Lavender (*Lavandula*), Rosemary (*Rosmarinus officinalis*), Mint (*Mentha*), Lemon Balm (*Melissa officinalis*), Pineapple Sage (*Salvia elegans*)**

D. Touch/Tactile

Touch is the most immediate sense, connecting us directly to the physical world. In universal design, tactile engagement is non-negotiable. It provides essential information for individuals with visual impairments, offers grounding for those with cognitive conditions and is a primary source of exploration for neurodivergent individuals. The goal is to provide a rich, safe tapestry of textures users can engage with on their own terms.

For users relying on non-visual cues, touch is a primary navigation tool. Plants with distinctive textures—like the furrowed bark of an oak or the soft leaves of Lamb's Ear—can serve as recognisable markers along a path (Kopeva et al., 2020; Yazici et al., 2018). Touching different textures can also stimulate sensory cognition and trigger memories (Rappe & Kivelä, 2005).

A universal tactile environment offers a balanced gradient of experiences. Create dedicated zones with a varied mix of safe textures: velvety, smooth, rough and bristly (Gaudion & McGinley, 2012). The priority is predictability and control, requiring clear, wide paths that prevent accidental brushing against foliage (Finnigan, 2023).

The principle of "safe to touch" is paramount. All interactive plants must be non-toxic and non-thorny. Varied textures must be positioned within comfortable reach using raised planters, hanging baskets at accessible heights and low-growing plants with interesting textures. Grouping plants with similar textures helps hypersensitive users navigate comfortably (Yazici et al., 2018).

A touch-inclusive design offers clearly defined zones—from boldly textural exploration areas to smooth calm spaces—connected by safe pathways. This empowers users to control their tactile interaction, transforming touch into a source of discovery and connection.

Plants (examples)

- **Soft/Fuzzy: Lamb's Ear (*Stachys byzantina*), Woolly Thyme (*Thymus pseudolanuginosus*)**
- **Smooth/Waxy: Stonecrop (*Sedum* sp., non-toxic varieties), Swedish Ivy (*Plectranthus verticillatus*)**

- **Rough/Textured: Paper Birch (*Betula papyrifera*), Soft Ornamental Grasses (*Pennisetum*)**
- **Crinkly/Brittle: Honesty (*Lunaria annua*) seed pods**

E. Taste/Gustatory

The sense of taste offers the most direct interaction with a plant. Incorporating edible plants is a powerful strategy for universal engagement, fostering learning, sparking memory and encouraging social interaction. However, safety and clarity are paramount. A taste garden must be an unequivocally safe zone where every plant is non-toxic and easy to harvest.

Edible gardens serve multiple purposes. For children and newcomers, the cycle of planting, nurturing, harvesting and tasting delivers hands-on education about life cycles and ecosystems. Familiar tastes from herbs and fruits can evoke powerful memories, especially valuable in dementia care or community gardens (Gray, 1999; Sustainable Gardening Australia, 2025). For neurodivergent individuals who may engage in sensory-seeking oral behaviours, providing a designated safe space for tasting is a positive design response (Finnigan, 2023).

The primary rule is absolute: every plant in a tasting area must be non-toxic and safe for consumption, with soils free from pesticides. Edible plants must be physically easy to locate and harvest, using raised beds, containers and vertical planters to bring produce to a comfortable height. Incorporate plants with distinct taste profiles—sweet fruits, sour leaves, savoury herbs and mild greens—to engage a range of palates.

A tasting garden should be celebratory and unambiguous. It must be visually and physically distinct, with 100% of its contents being safe for consumption. This empowers users to explore confidently, turning passive observation into active participation.

Plants (examples)

- **Fruits/Vegetables: Cherry Tomatoes, Strawberries, Snap Peas, Pole Beans, Lettuce, Radishes, Pumpkins/Squash**
- **Herbs/Edible Flowers: Nasturtium, Basil, Chives, Mint, Sunflower seeds**

F. Movement, Balance & Proprioception

Beyond sensory qualities, plants support proprioception—the body's sense of its own movement and position. Their selection and arrangement directly influence this internal sense, creating topography, spatial definition and navigational challenges that engage users physically.

Strategically designed planting can create gentle slopes for climbing, establish clear edges with varied textures for balance feedback, and use shrub density to create spaces that feel expansive or enclosed. Sturdy, low-branching trees offer natural supports for leaning, while varied pathway surfaces bordered by planting provide underfoot cues that aid spatial awareness.

The physical environment can provide organising input for the nervous system. Incorporate opportunities for strong physical feedback, such as stepping stones of varying heights or areas for lifting natural materials like logs. These activities provide grounding

sensory input that can help regulate energy levels and improve focus.

Use "soft" visual dividers like low planting to define spaces without creating confinement. A predictable layout with clear landmarks reduces anxiety related to movement (Gaudion & McGinley, 2012).

For individuals with challenges in depth perception or spatial awareness, use strong visual contrasts to define edges and establish unambiguous boundaries. This creates a predictable spatial framework supporting confident movement.

Incorporate simple, safe elements that develop gross motor skills at an accessible scale, such as low climbing structures designed for use by people of all ages and abilities (Polat et al., 2017).

Design the landscape as an active partner in movement. It should offer a graduated series of physical experiences—from calming pathways to optional motor challenges—within a framework of spatial clarity. By supporting the body's sense of itself in space, the garden promotes physical accessibility, confidence and the joy of movement for every user.

4. User Group Considerations

Universal design principles are applied in service of people. Successful planting is woven from an understanding of specific user groups—children, older adults, wheelchair users, neurodivergent individuals and the broader community. By considering these groups holistically, designers create layouts and selections that are both accessible and deeply engaging.

Physical access is the foundational layer of inclusion. Attention must be paid to changing needs across the lifespan, from the low vantage point of a child or wheelchair user to the reduced mobility of an older adult.

A primary intervention is the strategic use of raised beds and containers. Elevating the planting surface brings soil, plants and gardening activity within comfortable, independent reach. Sensory plants with interesting textures and fragrances must be positioned so their most engaging features are accessible at or below standard eye level.

The circulation network is equally critical. Pathways must be wide, smooth, firm and level to accommodate wheelchairs, walkers and strollers. They should form a clear, intuitive loop. Planting alongside these routes should adhere to a "high-branching and low-planting" scheme to maintain vital sightlines for safety, supervision and a feeling of openness.

An accessible garden naturally becomes multi-generational. A child can sow seeds in a raised bed alongside a seated grandparent, fostering connection through shared activity. Including plants with nostalgic value, such as old-fashioned roses or fragrant herbs, can trigger reminiscence in older adults and spark intergenerational conversation (Gray, 1999).

True universality also respects cultural specificity. Plant selection should be rooted in local context. Consulting with community members to include culturally significant species fosters a sense of ownership, belonging and intergenerational knowledge sharing (Beckwith & Gilster, 1996).

Designing for user groups is an integrative process. Viewing each decision through multiple lenses—physical ability, sensory engagement, cultural context—creates landscapes that are universally meaningful.

5. Maintenance Considerations

The long-term success and inclusivity of any planted environment depend on a realistic maintenance strategy. Maintenance is a critical design parameter that must be addressed from the outset through plant selection, material choices and spatial planning.

The most significant maintenance decisions are made during design. Selecting low-impact plants can drastically reduce long-term labour and cost. Avoid species known to be invasive, susceptible to pests, or that generate excessive debris. Particular attention should be paid to plants that drop slippery leaves, messy fruits or hard seeds onto pathways, creating persistent hazards and increasing cleanup burdens. Consider root control barriers for large trees near paved areas to prevent costly damage (Wojnowska-Heciak et al., 2022).

Maintenance must preserve safety and accessibility. Poorly maintained greenery can render spaces inaccessible or unsafe.

Routine, strategic pruning is a critical safety practice. Its primary functions are to maintain clear sightlines, prevent vegetation from obstructing pathways or signage, and ensure tree canopies remain high and open. Pathways must be kept meticulously clear of debris and surface irregularities to ensure safe passage.

For allergy management, mow lawns regularly to prevent pollen release, or replace high-pollen grass areas with shrub beds or other

ground covers (Asthma Society of Ireland, n.d.; Green et al., 2018). Proactively clean leaf litter and fruit fall from walkways.

For neurodiverse users, consider the impact of maintenance noise. Providing advance notice of noisy activities and scheduling them during quieter times can make spaces more usable. Involving users in safe, appropriate tasks like watering or light weeding fosters ownership and therapeutic engagement.

Anticipating growth involves planning for succession, pruning and eventual replacement. Selecting plants with appropriate growth rates and final sizes minimises future burdens and prevents spaces from becoming inaccessible due to overgrowth. Designing for growth ensures the enduring and equitable usability of the space.

Maintenance is the ongoing dialogue between design and real-world use. By selecting appropriate plants and establishing routines that prioritise safety, accessibility and ecological health, we preserve the universal benefits of planted environments for the long term.

6. Conclusion

The principles of universal plant selection reveal a profound truth: integrating nature into our environments is a powerful act of inclusive design. This is about thoughtfully weaving the multi-sensory, evolving qualities of plants into shared spaces to support the vast spectrum of human need.

The deliberate application of universal design principles actively shapes planting into a therapeutic instrument. This connection is formalised in Horticultural Therapy, which systematically harnesses engagement with plants to enhance holistic wellbeing.

The evidence is compelling: a well-designed space can help a neurodiverse child regulate emotions, provide a person with anxiety a focus for mindful engagement, or offer someone with memory loss a tangible connection to their past through scent and touch. These outcomes are the direct result of intentional choices about safety, sensory zoning, seasonal interest and accessible engagement.

The ultimate goal is to facilitate profound joy and meaningful engagement with the living world. True accessibility extends beyond level pathways and reachable heights to encompass the deeper accessibility of experience—the universal capacity to form personal connections, navigate via multi-sensory cues, feel secure and welcomed, and participate in nurturing life.

This framework gains its true power when adapted to local and cultural context. The most resonant and inclusive planting reflects the community it serves, incorporating plants of cultural significance and selecting species ecologically suited to thrive.

Universal design in plant selection is an invitation to reimagine our relationship with nature as one that actively includes everyone. It is a philosophy that views human diversity as the essential inspiration for creating more empathetic and vibrant landscapes. By embracing these principles, we cultivate far more than plants; we cultivate equity, nurture wellbeing and grow shared joy.

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