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Breaking New Ground in Heritage Valuation: A Comprehensive Use of Discrete Choice Experiments

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Abstract: Heritage authorities must decide which places to protect, but valuation studies usually examine a single named site. We develop a common way to describe buildings, historic sites and landscapes, and test it in a choice experiment with 1,613 Victorian respondents. The results show higher mean willingness to pay for nineteenth-century age and excellent condition in all three categories, while the value attached to distance differs across them. Images also affect stated values in the later survey designs, although many individual image comparisons remain uncertain. We show how the estimated characteristics combine in an illustrative courthouse profile. A shared set of characteristics makes comparisons possible, but it does not make the monetary values interchangeable or establish that they transfer to new places. The framework can help structure heritage appraisal while making those limits explicit.

Keywords: cultural heritage, historic preservation, non-market valuation, discrete choice experiment, public preferences

JEL codes: C51, H43, Z18, Q51

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1. Introduction and research aim

Heritage authorities make decisions across buildings, historic sites and landscapes, many of them far less famous than the places that usually appear in valuation studies. They need evidence about how people value protection across this broader stock. Yet the character and significance of each place differ, so a value estimated for one named site cannot simply be assigned to another (Tuan et al., 2009; Wright & Eppink, 2016).

These decisions matter because damage to built heritage can be difficult to reverse. Conservation policy must weigh the benefits of protection alongside its costs, including benefits for people who may never visit a place but care that it survives (Australia ICOMOS, 1999; Navrud & Ready, 2002). Public preferences can inform that comparison, although no monetary exercise captures the full cultural meaning of a place (Mason, 2008; Avrami et al., 2019).

Stated preference surveys ask people to choose between described policy outcomes. They can estimate the value of protecting heritage that has no market price (Carson et al., 2001; Mourato & Mazzanti, 2002; Champ et al., 2017). Existing evidence, however, often concerns iconic sites or particular tourism services. It can be highly informative for those decisions while offering less guidance when an authority must compare many different assets (Noonan, 2003; Lawton et al., 2020; Throsby et al., 2021).

One response is to describe a place through characteristics that can also be observed elsewhere: its type, age, condition, access and protection arrangements. A choice experiment can then ask how much each characteristic contributes to the value of a protection proposal, while retaining differences between kinds of heritage (Morey et al., 2002; Carson & Czajkowski, 2014). Throsby et al. (2021) demonstrate the promise of this approach for historic buildings in Australia.

The harder question is whether one such framework can describe a much wider range of heritage without making the descriptions meaningless to respondents. It must preserve differences between asset types while using attributes that are relevant to policy and defined consistently across places. The attributes also determine what respondents are able to value: symbolic, contested and lived meanings may remain outside the survey.

This study develops and applies such a framework in Victoria, Australia. It covers buildings, historic sites and landscapes in one survey, with category-specific types and a common set of observable attributes. We examine how age, condition, access, distance

and management affect the value of protection, and whether the same characteristic has the same monetary value across categories.

We also examine two features that matter when moving from a named site to a described asset. First, people saw different images in the later survey designs; an image may convey information that the written attributes do not. Second, protection programmes covered different numbers of places, so a value for one place need not scale proportionally to a larger programme. These tests help establish how the reported values should be interpreted.

The resulting estimates can be combined for an explicitly described heritage profile. Such a calculation offers a clearer starting point for appraisal than copying a value from an unrelated landmark. Whether it predicts values for a new place remains a question for independent validation (Riganti & Nijkamp, 2005; Lawton et al., 2021).

Our contribution is therefore a practical language for comparing diverse heritage assets and an empirical test of where that language holds together. We show which patterns recur across categories, where values differ, and how imagery and programme size complicate the comparison. The aim is to make public preferences usable in heritage decisions without presenting a common attribute list as a universal price list.

2. Valuing heritage across places

A valuation survey can capture benefits from visiting a heritage place and from knowing it will be protected for others or future generations. The latter benefits help explain why even inaccessible archaeological material may be valued (Lundhede et al., 2013). Choice experiments present alternatives with defined characteristics and payments, allowing these preferences to inform policy appraisal (Johnston et al., 2017; Mariel et al., 2021).

A named place brings its own history and associations into a choice. That is useful for a site-specific decision but makes it difficult to separate the value of its characteristics from the value of its identity. Existing studies illustrate the range of heritage benefits, from archaeological discoveries at Vindolanda to landscape conservation in the Alto Douro (Kinghorn & Willis, 2008; Lourenço-Gomes et al., 2014). Their estimates need not apply to a different place.

Describing assets through shared characteristics helps make comparisons possible. Work on historic buildings shows that people can value such characteristics without being asked to value an iconic name (Throsby et al., 2021). It does not follow that every asset fits the same

description, that attributes are psychologically independent, or that a coefficient transfers unchanged between categories. Those are empirical and interpretive questions for the present study.

The policy change also matters. Some heritage choice studies value visitor facilities or adaptive reuse while assuming that the underlying asset remains protected (Choi et al., 2010; Bertacchini & Frontuto, 2024). Here the choices concern additional protection itself. This allows us to study a benefit that can extend beyond visits, while recognising that the survey still captures only the aspects of heritage described to respondents (Provins et al., 2008).

3. Material and methods

3.1. Study overview

The Heritage Council of Victoria and Heritage Victoria commissioned a survey of residents' choices about additional protection for heritage places. We analyse the three categories of immovable heritage and measure how each stated characteristic changes willingness to pay. The survey also asked broader questions about heritage, which fall outside this paper.

The survey described heritage protection at both state and local levels. Places of state significance were represented through the Victorian Heritage Register, and locally significant assets through municipal heritage overlays. The contemporary questionnaire referred to approximately 2,400 registered places and objects and approximately 175,000 places in local overlays. These figures describe the survey context rather than current registry totals (White et al., 2017).

The online supplement gives full sample counts, model equations, estimation checks and parameter tables. The main text describes the survey choices and what the estimates mean.

3.2. Choosing the attributes

The attributes had to work across very different places and still describe things that heritage authorities can observe and manage. We therefore sought characteristics that respondents could understand, that mattered to protection policy, and that could be assigned consistently to real assets in the Victorian heritage system.

The questionnaire covered Buildings, Historic Sites, Landscapes and movable Heritage Objects. This paper concerns the three categories of immovable heritage. Objects used a different attribute structure and are excluded from the present econometric analysis.

Each category has its own asset types. Buildings include homes, industrial buildings and places of worship; Historic Sites include settlements, mining sites and shipwrecks; and Landscapes include agricultural and natural landscapes as well as features such as bridges and lighthouses. These types retain differences that a common attribute list would otherwise conceal.

Across the categories, the same questions describe age, condition, heritage designation, development controls, access, other management measures, distance and the number of places protected (Table 1). Respondents also saw a one-off individual cost. The common attributes allow comparisons across asset types; they do not imply that a given attribute must have the same value everywhere.

Table 1. Generic attributes and their levels for heritage asset valuation.

Attribute dimension	**Attribute**	**Attribute levels**
Common asset characteristics	Age	19th century (1803-1900) Early 20th century (1901-1918) Interwar period (1919-1945) Post war (1946-70) 1971 to present
	Condition	Excellent condition - structurally sound, well maintained, weather-tight, with no or minor repairs needed Good condition - structurally sound, reasonably maintained but in need of minor or localised repair Poor condition - deteriorating structure, showing signs of a lack of general maintenance Very poor condition - structural failure or clear signs of structural instability, or serious loss of weather-tightness
	Access	Public access – free Public access – with entry fee Public access – for commercial purposes Private access only
Policy and management attributes	Rating	Inclusion in National Heritage Register (National Significance) Inclusion in Victorian Heritage Register (State Significance) Inclusion in local heritage overlay (Local Significance)

	Protection type	Subject to approval - any building or site alterations or additions or developments on the land are undertaken sympathetically, subject to permit approval Exterior subject to approval - exterior alterations to the listed place are subject to permit approval, internal changes have no permit requirement or are subject to specified permit exemptions; changes must be sympathetic and additions should not be easily visible from the street Permit policy seeks to limit further development
	Control of visitation	The number of visitors to the site/place is restricted by management to protect the integrity of the building. No
	Control of traffic	Vehicular and or pedestrian traffic is restricted around the place/site to either protect the structural integrity of the site/place or to contribute to a quiet atmosphere. No
	Control of noise	The surrounding environment is regulated to restrict noise and sound pollution impacting on people's experience of the site/place. No
	Security measures	Measures taken to secure the asset from damage such as fire, flooding, theft and vandalism No special security measures
Scope and spatial context	Distance	From <1 to >100 km
	Number of places	From 1 to 10 assets protected
	Cost	1, 2, 5, 10, 20, 50, 100, 200 AUD

Reference levels are: 1971 onwards; very poor condition; local heritage designation; the most restrictive development regime; no additional visitation, traffic, noise or security measures; and private access. Distance bands were coded at 0.5, 2, 4, 7.5, 30, 75 and 100 km. Programme sizes were 1, 2, 5 and 10 places; the initial design concerned one place only. Costs are a one-off individual payment in AUD.

This is an operational description of heritage, not an exhaustive account of cultural significance. The survey cannot represent every meaning attached to a place, including

contested histories, emotional connections or lived experience. Those limits matter when the estimates are used for a particular site.

The Victorian Heritage Register and stakeholder input informed the initial attribute set. The project report records two expert review sessions, which prompted changes to payment wording, programme size, category order and imagery. It also describes focus groups, cognitive interviews and a 500-person pilot, although complete counts and every pilot change cannot now be reconstructed. Experts and stakeholders helped decide which characteristics to ask about; the public supplied the choices from which their monetary values were estimated.

We treat attributes as separately describable, not as independent sources of meaning in a person's mind. Each estimate is conditional on the other characteristics in the model. Some design restrictions and changes also created associations among the presented attributes; these are considered in the analysis rather than assumed away.

3.3. Survey design and implementation

Respondents received information about the heritage policy context, definitions of the attributes and an example choice card (Fig. 1). Each task presented one protection proposal and the option not to support it. The instructions explained that non-protection meant no special heritage status: depending on the asset, it could be altered, demolished, moved or sold. This described a lack of additional safeguards, rather than certain or immediate destruction. Respondents were told that the scenarios were hypothetical and that their answers would inform future policy and practice.

Each respondent completed four tasks in each of four heritage categories, for a total of sixteen tasks. SurveyEngine rotated category sequences using a 24-condition order variable. Only the twelve tasks concerning immovable heritage are analysed here. Respondents were instructed to consider each proposal separately, without cumulating payments across tasks. The instrument framed payment as an additional one-off taxation cost to the individual respondent, with a similar cost for other Victorians in proportion to their income. Accordingly, all WTP estimates below are individual one-off amounts in AUD.

The survey used Ngene to generate category-specific choice designs. An initial 180-row design was followed by two 90-row designs, which added image conditions and variation in programme size. The archived instructions record the design criterion, point priors and a restriction on two Historic Site types.

Matching the choices to the archived versions identified three groups within the 1,613-person analysis sample: 334 respondents saw one place with the reference image only; 570 and 709 respondents saw the two later designs with different images and programme sizes. Supplementary Table A1 gives their fieldwork dates. The primary image comparison uses only the later 1,279 respondents.

Figure 1. Example of a choice card for Shipwrecks



Reference images were selected with project stakeholders from the heritage database and visually harmonised to support interpretation. An alternative exemplar for each type and a no-image condition (Fig. 2) were introduced in later designs following expert concern about image selection. These conditions were encoded jointly with the other design attributes. Image variation was not present in the initial survey version, and the combined data therefore do not form a simple three-arm experiment across all respondents. Our main image analysis uses only respondents exposed to the later image/scope designs and controls for design cohort and programme size.

The protection proposal, no-protection alternative and individual payment address central design questions in stated-preference guidance (Johnston et al., 2017). The survey told respondents that their answers would inform future policy. These features do not establish that respondents believed their choices would have consequences, or remove possible bias in hypothetical answers. The surviving records support a careful account of what was fielded, rather than a claim of complete compliance with every guideline.

Figure 2. Reference image, alternative image and no-image condition for Residential Landscapes



3.4. Data collection and analysis samples

Adult Victorian residents were recruited through two online panels, Toluna and Research Now. Age and gender quotas were managed against 2016 Census information. Project records describe screening of small-screen devices, manual review of open-ended answers, and a timeout after thirty minutes without a response. The timeout was an inactivity rule, not a maximum permitted completion time. The retained respondents' start timestamps span 9–31 October 2017 in Victorian local time. This analysis uses the final supplied data and weights, which contain 1,613 respondents with complete four-task panels in each analysed category.

The full estimation sample therefore contains 6,452 choices per category and 19,356 choices across the three categories. The image analysis contains 1,279 respondents and 5,116 choices per category. The first design cohort contributes to the main attribute models, with cohort intercept controls, but not to the primary image comparison. Appendix A describes both analysis samples. Weights were supplied to align age and gender proportions after quality screening and were normalised to mean one within each estimation sample. Calibration on these variables does not make an opt-in online panel a probability sample.

3.5. Estimating and interpreting values

We estimate separate models for Buildings, Historic Sites and Landscapes from each respondent's repeated choices. The models allow people to differ in their preferences for the common attributes and in their general support for protection. The asset-type and survey-version effects are fixed, as is the negative payment coefficient within each category. The latter

lets us express the mean attribute effects as individual willingness to pay (Train & Weeks, 2005; Scarpa et al., 2008). Supplementary Appendix B gives the formal model.

We also examined a simpler model with only random general support for protection and a model allowing payment sensitivity to vary. The simpler model scores better on standard fit measures that penalise extra parameters, but the richer model lets us report mean preferences without assuming identical attribute effects for everyone. Some estimated variation is poorly determined, and the varying-payment model gave unstable results in the image analysis. We therefore use the same fixed-payment specification throughout and interpret the mean effects and their uncertainty, rather than treating every estimated variance as a substantive finding.

An attribute estimate describes the change in mean willingness to pay when that characteristic changes from its reference level and the others stay the same. For example, the age estimate compares an otherwise similar nineteenth-century asset with one dating from 1971 onwards. An asset-type estimate is only one part of a complete profile value; Section 4.3 shows how the parts fit together.

For the later designs, we estimate how the effect of an image varies by asset type and programme size. We also account for differences between the two survey versions. The reported image comparisons refer to programmes protecting one place; Supplementary Appendix B describes the additional terms used to test the full pattern.

We fit the models using 8,192 simulated draws per respondent and check the results with an independent second set of draws. Uncertainty estimates account for repeated choices by the same person; comparisons between categories also account for the fact that the same people evaluated each category. The full likelihood, numerical checks and covariance calculations are in Supplementary Appendix B. These checks support inference about average effects but do not resolve uncertainty about near-zero estimates of preference variation.

4. Results

4.1. Attribute values and programme scope

Table 2 and Fig. 3 show how the common characteristics change mean willingness to pay, with uncertainty around each estimate. Each comparison holds the other stated characteristics fixed. The full list of type effects, survey-version effects and estimated preference variation appears in Supplementary Table D1. A standard deviation in that table describes variation

across people under the model; the standard error beneath an estimate describes how precisely the parameter is estimated.

Across all three categories, older assets and those in excellent condition tend to attract higher values. Compared with an otherwise similar asset dating from 1971 onwards, a nineteenth-century asset adds 48.68 AUD for Buildings, 33.06 for Historic Sites and 87.42 for Landscapes. Excellent rather than very poor condition adds 67.13, 29.60 and 40.67 AUD, respectively. These are conditional mean differences, not complete values for individual places.

Free public access, compared with private access, also raises estimated mean willingness to pay: 30.72 AUD for Buildings, 16.58 for Historic Sites and 27.42 for Landscapes. Other access and management effects are less uniform; Table 2 and Fig. 3 show their estimates and uncertainty.

Table 2. Mean WTP for the common attributes in the main models

Attribute	Buildings	Historic Sites	Landscapes
Age - 19th century (1803-1900)	48.68*** (11.63)	33.06*** (11.56)	87.42*** (12.90)
Age - Early 20th century (1901-18)	35.25*** (11.90)	20.33* (10.89)	40.67*** (11.82)
Age - Interwar period (1919-45)	22.98** (11.17)	24.26** (11.47)	10.00 (11.28)
Age - Post war (1946-70)	11.78 (10.92)	13.61 (10.75)	20.31* (11.36)
Condition - Excellent	67.13*** (11.38)	29.60*** (10.02)	40.67*** (9.99)
Condition - Good	30.59*** (10.67)	27.09*** (9.71)	33.04*** (10.04)
Condition - Poor	13.33 (9.96)	-5.90 (9.08)	7.11 (10.15)
Designation - National	-8.74 (9.26)	-9.38 (8.21)	2.83 (8.95)
Designation - Victorian	20.11** (8.85)	-16.63** (8.27)	-0.25 (8.72)
Development - All changes subject to approval	11.14 (9.18)	-6.61 (8.25)	-7.06 (8.87)
Development - Exterior subject to approval	25.60*** (9.45)	-21.27*** (8.16)	10.10 (8.48)

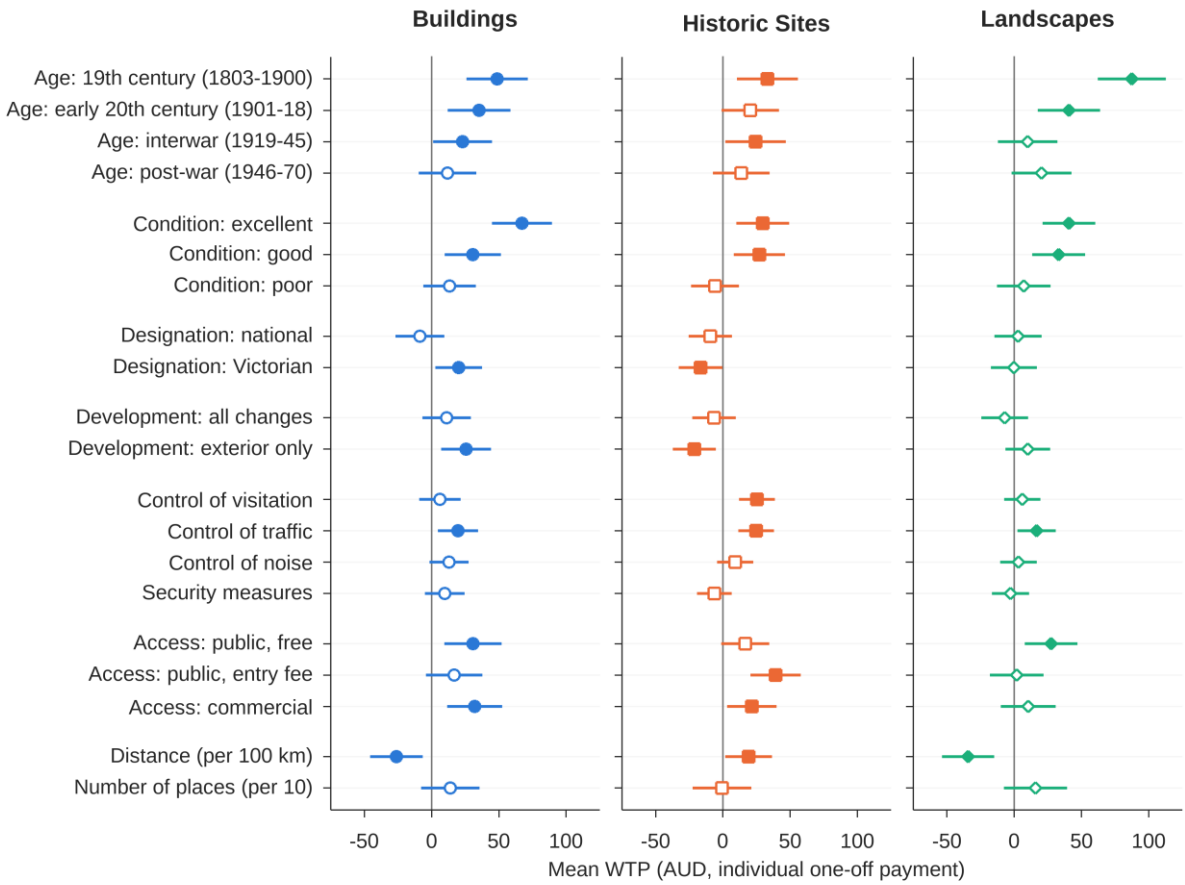
Attribute	Buildings	Historic Sites	Landscapes
Control of visitation	6.14 (7.85)	25.29*** (6.80)	6.01 (6.87)
Control of traffic	19.57** (7.62)	24.68*** (6.76)	16.63** (7.27)
Control of noise	12.92* (7.41)	9.10 (6.86)	3.17 (6.94)
Security measures	9.73 (7.52)	-6.37 (6.58)	-2.75 (7.05)
Access - public free	30.72*** (10.86)	16.58* (9.11)	27.42*** (9.99)
Access - public with entry fee	16.73 (10.70)	39.15*** (9.53)	1.86 (10.17)
Access - commercial	31.99*** (10.43)	21.48** (9.38)	10.43 (10.41)
Distance (100 km)	-26.18*** (9.98)	19.10** (8.87)	-34.28*** (9.89)
Number of places (per 10)	13.88 (11.08)	-0.70 (11.13)	15.82 (11.98)
Cost coefficient per AUD 100 †	-1.242 (0.130)	-1.376 (0.134)	-1.113 (0.101)
Model diagnostics			
LL at convergence	-3,767.977	-3,884.356	-3,953.171
LL at constant only	-4,360.325	-4,470.719	-4,465.041
McFadden's pseudo-R^2	0.1358	0.1312	0.1146
n (choices)	6,452	6,452	6,452
r (respondents)	1,613	1,613	1,613
k (free parameters)	62	49	54

Notes: Mean WTP for an individual one-off payment in 2017 AUD, relative to the reference levels listed below Table 1; respondent sandwich standard errors are in parentheses. Distance is per 100 km and programme scope per ten places. The cost row is -100λ, the utility coefficient on payment in hundreds of AUD with a delta-method standard error; it is not WTP. All models also include asset-type intercepts, design-cohort controls, a zero-mean random preservation intercept and normally distributed random coefficients for all twenty attributes. Supplementary Table D1 reports all 62, 49 and 54 free parameters, including the standard deviations, with further fit indices.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$: two-sided normal Wald tests using respondent sandwich covariance. Stars are pointwise and unadjusted for multiplicity; absence of stars is not a finding of no effect. † The sign-constrained cost coefficient receives no ordinary zero-null Wald star.

Diagnostics: LL values use weights normalised to mean one. The constant-only comparator is a binary logit with one protection intercept on the same sample. McFadden's index is $1 - LL/LL_0$. Definitions of the Ben-Akiva–Lerman index and information criteria are given with Table D1.

Figure 3. Mean WTP for the common attributes, by heritage category



Notes: Markers show the mean WTP estimates of Table 2 (AUD, individual one-off payment), relative to each attribute's reference level; horizontal bars are pointwise 95% confidence intervals from the respondent sandwich covariance. Filled markers indicate intervals that exclude zero. Distance is per 100 km and programme scope per ten places.

Distance matters differently across categories. For an additional 100 km, the estimated change is −26.18 AUD for Buildings and −34.28 for Landscapes, but +19.10 for Historic Sites. The positive Historic Sites estimate should be read within the distances offered in the survey; it does not imply that more distant sites are always preferred.

The estimated linear effect of protecting more places is imprecise in all three categories (Table 2). A programme value therefore cannot be converted into a reliable price per place by simple division. The later survey designs also allow the relationship between programme size and value to differ with the displayed image; those tests appear in Supplementary Table B2.

For Historic Sites, the test of a linear relationship within all three image conditions is close to, but does not meet, the conventional 5% threshold ($p=0.052$). This is another reason to avoid treating the programme effect as a fixed amount for each additional place.

Although the same attributes describe all three categories, a joint test rejects equality of their mean values across categories ($p<0.001$; Supplementary Table B2). The common framework supports comparison; it does not supply a single set of monetary values to apply everywhere.

One example is distance: the Historic Sites estimate exceeds the Buildings estimate by 45.27 AUD per 100 km (SE 12.95). This comparison accounts for the fact that the same respondents valued both categories.

4.2. Visual representation

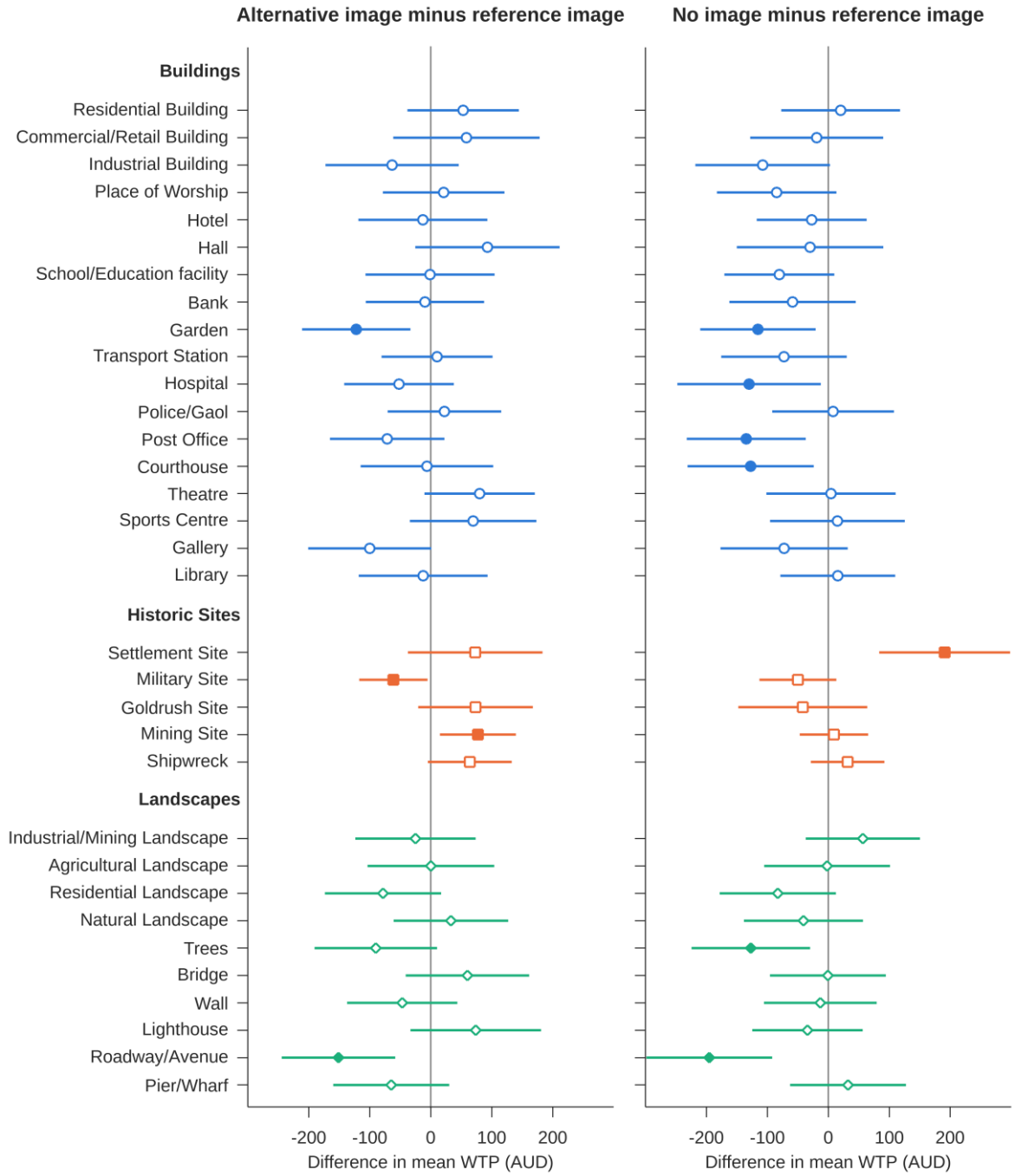
The way an asset is pictured can affect stated value, but it does not affect every asset type in the same way. Testing all image differences together, including their interactions with programme size, gives evidence of an effect in each category. After adjustment for testing three categories, the evidence is strongest for Buildings and Historic Sites and weaker for Landscapes (adjusted $p<0.001$, $p=0.002$ and $p=0.041$, respectively). The tests use the 1,279 respondents who saw the later image designs.

A narrower test that looks only at Buildings with a one-place programme is much less clear ($p=0.100$). The broader result should therefore not be read as evidence that every image changes the value of every building. Supplementary Table B5 gives the corresponding tests for the alternative model and simulation seed.

Fig. 4 shows the estimated difference between each alternative or absent image and the reference image for a one-place programme. The wide intervals around many individual contrasts make the heterogeneity visible. Their values and intervals are listed in Supplementary Table D3; the joint tests, rather than any one contrast, are the main evidence that imagery matters.

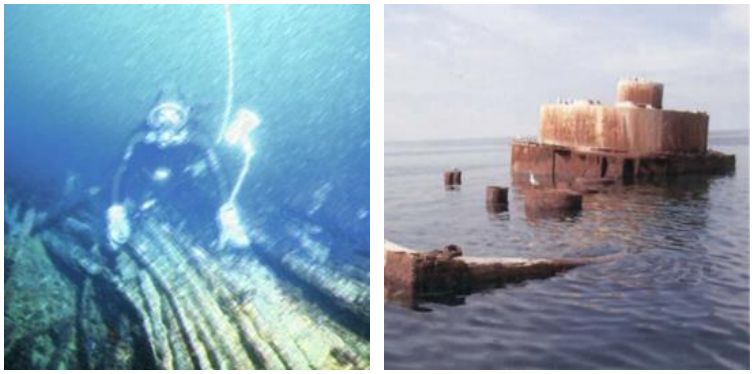
The left and right exemplars in Fig. 5 illustrate why two images of the same named asset type may provide different contextual information. The experiment estimates differences between these representations; it cannot determine whether a difference arises from aesthetics, recognition, interpretation or other visual features. Neither image can be treated as a uniquely neutral representation of the type.

Figure 4. Image contrasts in mean WTP for a one-place programme



Notes: Differences in mean WTP (AUD) relative to the reference image, with pointwise 95% confidence intervals from the full respondent sandwich covariance; 1,279 respondents and 5,116 choices per category. Filled markers indicate intervals that exclude zero. Intervals are not adjusted for multiple comparisons; the category-level joint tests reported in the text are the primary inferential summary. Estimates are listed in Table D3, and complete image-model estimates in Table D2.

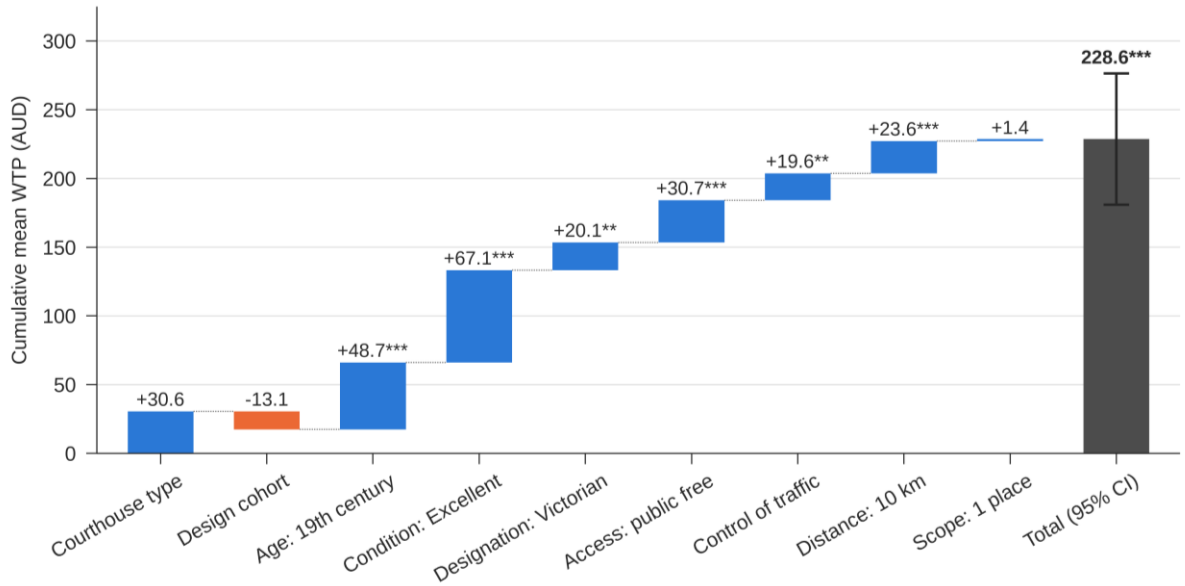
Figure 5. Reference and alternative exemplars for Shipwrecks



4.3. Reading a profile valuation

Consider a hypothetical nineteenth-century courthouse in excellent condition, with Victorian designation, free public access and traffic control, 10 km from the respondent. The proposal protects this one place; the other characteristics are at their reference levels. Fig. 6 shows how each feature contributes to the estimated value, and Supplementary Table C2 lists the components and their uncertainty.

Figure 6. Components of the illustrative courthouse profile



Notes: Bars show the contribution of each component to mean WTP (AUD, individual one-off payment), accumulated from left to right. Labels give the contributions with stars for two-sided respondent-sandwich tests (*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$). The last bar is the total, with a 95% confidence interval based on the covariance of all components.

For this profile, the estimated mean willingness to pay is 228.63 AUD as an individual one-off payment (95% confidence interval [180.88, 276.38]). The interval reflects uncertainty in the combined estimate, including how the component estimates move together. This is an illustration of the calculation, not a valuation validated for a real courthouse. It cannot be treated as an annual payment or multiplied by a household count without a separate aggregation analysis.

5. Discussion

A shared set of characteristics lets people compare otherwise very different heritage places. The consistent premiums for age and condition suggest that some patterns of preference recur across categories. Yet the different distance estimates and the joint comparison of attributes show why a common description should not be mistaken for a common monetary price list.

The common attributes nevertheless reveal both recurring and category-specific patterns. Older assets attract higher mean values in all three categories, consistent with age acting as an observable indicator of historical significance (Throsby et al., 2021). Condition, access, designation, development controls and management measures vary more across categories. These differences do not identify the underlying mechanisms or imply that one regulatory regime is more efficient; they show that common characteristics need not carry a universal monetary value across different kinds of heritage. This matters when values are transferred to new decisions. A building estimate should not automatically be used for a historic site simply because both have an age or a designation. Studies of heritage sites in Thailand and Vietnam and across English heritage sites show how transfer performance can be tested in cultural settings (Tuan et al., 2009; Lawton et al., 2021). The present study does not perform such a test.

Research on environmental public goods remains useful here because the protection of species and heritage can both involve benefits for non-users and losses that may be irreversible. Those similarities help frame questions about what is being valued and whether the size of a protection programme matters. They do not establish that numerical values transfer between environmental and cultural goods. Our argument for testing transfer within heritage rests on heritage studies, with related evidence from other cultural goods (Zawojska et al., 2026).

These results should not be converted into a universal value per protected place. The mix of places in a programme, possible substitution among them and the uncertainty in the scope estimates matter. Substitution or diminishing marginal value may help explain the weak programme-size effects, but the present design does not distinguish these mechanisms. The distance estimates also describe responses within the surveyed setting; they do not measure the full geographical reach of heritage benefits. Their different directions across categories nevertheless suggest that the spatial extent of benefits should be treated as an empirical question rather than assumed to be uniform across heritage types.

The image results need similar care. Only the later respondents saw all three image conditions and different programme sizes. Comparing those designs while accounting for the survey version and programme size addresses an important design difference, but an image can communicate many things at once. Our contrasts cannot tell whether respondents reacted to beauty, recognition, historical associations or another feature of the exemplar.

A further issue is that images may convey contextual information beyond the asset type they are intended to illustrate and may therefore overlap with experimentally specified attributes (Bateman et al., 2009; Patterson et al., 2017). In the Shipwreck example, a fully submerged wreck may provide cues relevant to how respondents interpret accessibility even when access is separately described. The present experiment cannot identify whether this mechanism explains the image contrasts, but it supports pretesting alternative exemplars and examining sensitivity to visual representation.

For a policy appraisal, a profile value should always be tied to a stated protection change, population, payment and range of characteristics. It can then be considered alongside conservation costs and cultural assessments that the survey does not capture. The courthouse example demonstrates the calculation and its uncertainty, not a ready-made valuation for a real site. At the same time, the common attribute structure provides a consistent basis for comparing the public benefit component of protection decisions across otherwise heterogeneous heritage assets, complementing rather than replacing site-specific cultural assessment and information used in appraisal (Mason, 2008; Avrami et al., 2019; Throsby et al., 2021).

5.1. Limitations and future research

The chosen attributes cover observable aspects of heritage and its management. Expert and stakeholder input helped decide what could be shown in the survey, while respondents' choices determined the estimated monetary weights. This still leaves out contested histories, negative associations, emotional attachment and lived experience. Such meanings may require qualitative work and site-specific assessment before a decision is made.

The models allow preferences for the common attributes to vary, but keep some other effects and payment sensitivity fixed within a category. With only four choices per category per person, some individual variation is hard to estimate; several estimated standard deviations are near zero or change with the simulation seed. We focus on average preferences and their contrasts. The simpler and varying-payment models in Supplementary Appendix B show how

the main conclusions respond to those assumptions. Survey weights cannot eliminate selection into the online panel or bias from hypothetical choices.

Finally, the estimates have not been tested on a new heritage place or population. The same Victorian respondents evaluated all three categories, and the courthouse profile is calculated from those responses. Testing transfer accuracy requires independent valuations in a new setting and a prediction made before those outcomes are known.

6. Conclusions

A common description of heritage assets can help compare protection choices across a diverse stock. In the Victorian survey, nineteenth-century age and excellent condition attract higher mean willingness to pay in Buildings, Historic Sites and Landscapes, but distance works differently across them. Images and programme size also shape how a proposal is understood. The framework lets analysts combine stated characteristics into a profile value with uncertainty; it does not turn that value into a universal price or validate transfer to a new place. Those distinctions make the estimates more useful for careful, context-specific heritage appraisal. Used within these limits, the common framework can complement site-specific heritage assessment by providing a consistent basis for comparing the public-benefit component of protection choices across a wider heritage stock.

Supplementary material

Supplementary Appendices A-D contain the analysis samples, model and numerical checks, type and profile calculations, and complete parameter and image-contrast tables.

Data availability

The replication package contains the de-identified analysis data, MATLAB estimation and verification scripts, fitted models for both simulation seeds, respondent sandwich covariance matrices, and code that reproduces the reported tables, figures and sensitivity analyses. It is available at https://czaj.org/pub/materials/cjw_2026.zip. Release identifiers preserve the links between categories and design cohorts. Original identifiers, respondent timestamps and the identifying crosswalk are excluded; access to original survey records remains governed by the original data-sharing arrangements.

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Appendices

Appendix A. Analysis samples

Table A1. Design versions represented in the final analysis data

Survey version	Design	Respondents	Start dates in Victoria
8	180 rows; reference image; one place	334	9–10 October 2017
13	90 rows; three image conditions; four scope levels	570	19–23 October 2017
14	90 rows; three image conditions; four scope levels	709	28–31 October 2017
All	Main attribute models	1,613	9–31 October 2017
13 and 14	Primary image analysis	1,279	19–31 October 2017

Counts refer to respondents retained in the final analysis data, not to all survey starts or pilot recruits. The final sample contains 1,613 respondents, each contributing four choices in every analysed category. Fieldwork dates are derived from the retained start timestamps.

Table A2. Unweighted composition of the analysis samples

Characteristic	All respondents n = 1,613	Image sample n = 1,279
Age 18 to 24	5.9%	5.6%
Age 25 to 29	8.6%	8.9%
Age 30 to 34	11.8%	11.6%
Age 35 to 39	7.4%	7.2%
Age 40 to 44	7.7%	7.4%
Age 45 to 49	9.2%	9.1%
Age 50 to 54	11.2%	11.8%
Age 55 to 59	9.2%	9.3%
Age 60 to 64	8.6%	9.3%
Age 65 to 69	9.8%	10.2%
Age 70 and above	10.5%	9.7%

Characteristic	All respondents n = 1,613	Image sample n = 1,279
Gender Female	57.3%	56.9%
Gender Male	42.7%	43.1%
Education Degree or graduate qualification	46.6%	46.1%
Education Advanced diploma or diploma	13.3%	13.7%
Education Certificate	13.9%	14.7%
Education Year 12	12.2%	11.6%
Education Year 11	5.5%	4.9%
Education Year 10 or below	8.4%	8.7%
Education Other	0.2%	0.3%

Percentages are recalculated from the retained respondents. Education is recorded using the survey's response categories; the first category combines postgraduate qualifications, graduate diplomas/certificates and bachelor degrees. These descriptive percentages should not be compared with Census categories having different definitions or age denominators.

Appendix B. Econometric specification and diagnostics

For respondent i, task t and category c, let η_{itc} be the conditional utility difference between protection and non-protection. In AUD units, the mixed logit model is

$$\eta_{itc} = \lambda_c \left(a_{itc}'\alpha_c + x_{itc}'[\beta_c + D_c z_{ic}] + d_i'\kappa_c + \sigma_{0c} z_{i0c} - C_{itc}\right) \quad \text{(B1)}$$

The vector a contains asset-type indicators, x the common attributes, d the design-cohort indicators, and C the one-off individual payment. D_c is diagonal, with entries equal to common-attribute SDs. Its normal vector z_{ic} and the normal intercept draw z_{i0c} have independent standard normal components, shared across the four tasks. There are twenty random common slopes in the main models and twenty-two in the image models, where three scope indicators replace linear scope. The random-intercept mean is fixed at zero because the type indicators already span the preservation intercept. The image models additionally contain fixed type-by-image and image-by-scope mean shifts. The positive scale λ_c is estimated separately by category and held fixed across respondents; the utility coefficient on cost is $-\lambda_c$. This is a mixed logit model in WTP space, without an alternative-nesting structure.

$$P_{itc}(z) = \frac{1}{1 + exp(-\eta_{itc}(z))} \quad \text{(B2)}$$

$$L_{ic} = \int_{\mathbb{R}^K} \prod_{t=1}^{4} P_{itc}(z)^{y_{itc}} \left[1 - P_{itc}(z)\right]^{1 - y_{itc}} \varphi_K(z)\, dz \quad \text{(B3)}$$

Here y equals one for support of the proposal and zero otherwise. The vector z collects the intercept and slope draws; φ_K is the K-dimensional standard normal density. K is 21 in the main models and 23 in the image models. Equation B2 is conditional on these draws; their joint density is integrated in B3.

$$\ell_c = \sum_i w_i \, log \, L_{ic} \quad \text{(B4)}$$

Weights w_i are normalised to mean one within each estimation sample. We approximate the panel integral with 8,192 scrambled Sobol draws per respondent, using the same respondent draws in all four tasks and fixed draws throughout optimisation. The reporting seed is 179424673; an independent scramble, seed 179425682, provides a sensitivity check. Both use Matousek–Affine–Owen scrambling and a Threefry random stream. Two starts at 4,096 draws check optimisation. Across the six reported models, changing the final seed moves every mean coefficient by less than 0.13 of its reporting-run SE and changes mean-parameter SEs by less than 7%. Near-zero SD estimates are less stable; their local SEs do not resolve boundary

uncertainty. The existing mixed-logit implementation reproduces the new binary likelihood and analytical scores on complete respondent panels.

Let H be the observed Hessian of the weighted negative log likelihood, and let s_i be the unweighted respondent score. Inference uses

$$V = H^{-1} [\sum_i w_i^2 \, s_i \, s_i'] \, H^{-1} \quad \text{(B5)}$$

The Hessian is obtained by central differences of analytical gradients and checked for positive definiteness. Reducing the differencing step fivefold checks numerical stability of the standard errors. For joint cross-category tests, the three observed Hessians form a block-diagonal matrix and the respondent scores are stacked after aligning respondent identifiers. This retains the cross-products between a person's category-specific scores. The covariance remains conditional on the supplied weights; it does not account for uncertainty in how those weights were estimated.

Table B1. Numerical diagnostics for the reported models

Model	Weighted LL	Maximum score	Hessian rcond	SE step change	Seed change in SE
Main building	-3767.977	1.2e-05	2.2e-05	6.4e-08	0.127
Main historic	-3884.356	1.1e-05	5.2e-05	3.4e-08	0.032
Main landscape	-3953.171	4.3e-06	1.5e-05	5.5e-08	0.021
Images building	-2947.536	4.2e-05	4.8e-06	6.3e-08	0.098
Images historic	-3089.039	4.1e-05	5.8e-06	6.7e-08	0.116
Images landscape	-3110.636	5.9e-05	5.4e-06	3.9e-08	0.026

The Hessian-step column reports the largest relative change in any SE when the difference step is reduced fivefold. The seed column reports the largest mean-coefficient change, including the log cost parameter, in reporting-run SE units under an independent 8,192-draw scramble. All score norms concern free parameters. These checks support numerical inference for mean preferences; they do not imply that individual SDs or the behavioural specification are uniquely identified.

Table B2. Joint tests of cross-category equality and programme scope

Hypothesis	χ^2	df	p
Common means: historic = building	62.73	20	<0.001
Common means: landscape = building	29.34	20	0.081
All common attribute means equal	108.83	40	<0.001
building: All scope terms zero	9.19	9	0.420
building: Scope linear within each image condition	2.53	6	0.865
historic: All scope terms zero	13.42	9	0.145
historic: Scope linear within each image condition	12.48	6	0.052
landscape: All scope terms zero	8.83	9	0.453
landscape: Scope linear within each image condition	6.73	6	0.347

Scope tests use the image-analysis sample and permit image-specific responses. "All scope terms zero" has nine restrictions; linearity within all three image conditions has six. A non-rejection is not an equivalence test or proof of exact scope insensitivity.

Table B3. Specification sensitivity relative to the random-intercept-only benchmark

Model	RI only LL	Random slopes LL	ΔAIC	ΔBIC
Main building	-3779.263	-3767.977	17.43	125.15
Main historic	-3895.207	-3884.356	18.30	126.01
Main landscape	-3958.650	-3953.171	29.04	136.76
Images building	-2954.734	-2947.536	29.60	142.99
Images historic	-3097.836	-3089.039	26.41	139.79
Images landscape	-3116.626	-3110.636	32.02	145.40

The random-intercept-only benchmark has 20 fewer parameters for the main models and 22 fewer for the image models and uses adaptive one-dimensional normal integration. Positive differences favour that simpler benchmark; BIC here uses respondent count. These weighted criteria are descriptive. The richer specification is retained to relax identical attribute slopes, not because it wins a fit criterion. No ordinary chi-square likelihood-ratio test is applied to these weighted objectives or variance-boundary restrictions.

Relative to the simpler benchmark, every main-model mean WTP coefficient changes by less than 0.5 of its random-slope-model SE. Positive nineteenth-century age and excellent-

condition premiums and the directions of the distance gradients persist. The primary tests of all image and image-scope effects reject at 5% in both specifications and both final scrambling seeds (Table B5). The narrower Buildings test at one place is sensitive around the 10% threshold, so that result should not be presented as firm evidence of a baseline image effect.

Table B4. Sensitivity to a lognormal random cost coefficient

Model	Cost mean seed A	Cost mean seed B	Log cost SD A / B	Valid covariance A / B
Main building	-2.10	-2.21	0.79 / 0.82	Yes / Yes
Main historic	-6.70	-8.47	1.44 / 1.57	Yes / Yes
Main landscape	-1.71	-1.65	0.81 / 0.78	Yes / Yes
Images building	-34.19	-46.88	2.13 / 2.26	No / No
Images historic	-1.20	-1.35	0.14 / 0.38	Yes / Yes
Images landscape	-13.37	-28.45	2.11 / 2.41	Yes / No

Cost means are negative utility coefficients per AUD 100; they are not monetary WTP. Seeds refer to independent 8,192-draw scrambles. All optimisations reached the score tolerance, but observed-Hessian checks failed for both Buildings image fits and the second Landscapes image fit. Cost means also change sharply between seeds in those models. A small gradient alone is insufficient for valid inference. The fixed-cost specification is therefore used consistently across the main and image analyses, and random-cost results do not receive inferential stars.

Table B5. Stability of primary image tests across heterogeneity specifications and simulation seeds

Category	df	RI only p	Random slopes p seed A	Random slopes p seed B
Buildings	42	<0.001	<0.001	<0.001
Historic Sites	16	<0.001	<0.001	<0.001
Landscapes	26	0.049	0.041	0.038

Each test jointly sets all type-image and image-scope mean effects to zero. All three category-level tests also reject at 5% after Holm adjustment within each specification or seed. This does not imply that every individual image contrast differs from zero. The narrower one-place Buildings test gives p=0.1214 in the RI-only benchmark, 0.0996 in the reporting run and 0.1022 under seed B; its location around a threshold is not a robust substantive distinction.

Appendix C Type components and profile calculation

Table C1. Type components averaged over the weighted design-cohort composition

Asset type	Component in AUD	95% confidence interval
Buildings		
Residential Building	-71.56***	[-116.59, -26.52]
Commercial/Retail Building	-68.28***	[-115.53, -21.03]
Industrial Building	-47.57**	[-93.60, -1.54]
Place of Worship	-48.68**	[-95.20, -2.16]
Hotel	9.61	[-35.54, 54.77]
Hall	-45.83**	[-90.22, -1.43]
School/Education facility	-26.46	[-69.85, 16.94]
Bank	-57.95**	[-102.90, -13.01]
Garden	-0.73	[-45.33, 43.88]
Transport Station	14.48	[-30.77, 59.73]
Hospital	-43.83*	[-90.02, 2.36]
Police/Gaol	2.67	[-43.10, 48.43]
Post Office	10.89	[-34.21, 56.00]
Courthouse	17.47	[-27.57, 62.51]
Theatre	-6.34	[-53.83, 41.15]
Sports Centre	-109.72***	[-157.51, -61.94]
Gallery	23.16	[-24.06, 70.38]
Library	-21.68	[-65.57, 22.20]
Historic Sites		
Settlement Site	-6.73	[-50.81, 37.36]
Military Site	53.05***	[18.30, 87.80]
Goldrush Site	30.62	[-15.26, 76.49]
Mining Site	-52.58***	[-87.72, -17.44]
Shipwreck	15.11	[-19.36, 49.58]
Landscapes		
Industrial/Mining Landscape	-135.34***	[-180.95, -89.73]
Agricultural Landscape	-76.62***	[-120.07, -33.17]
Residential Landscape	-75.24***	[-116.17, -34.30]
Natural Landscape	-59.87***	[-101.18, -18.56]

Asset type	Component in AUD	95% confidence interval
Trees	-8.47	[-49.49, 32.55]
Bridge	12.96	[-26.58, 52.50]
Wall	-76.98***	[-118.05, -35.90]
Lighthouse	83.80***	[42.53, 125.08]
Roadway/Avenue	-58.06***	[-100.84, -15.27]
Pier/Wharf	-48.77**	[-89.59, -7.96]

These are components of the linear-scope model, evaluated at reference common attributes, the distance normalisation and zero programme size. They must be combined with the other profile characteristics before interpreting a total programme valuation. Cohort averaging changes the intercept component and its uncertainty; within-category type contrasts are unchanged.

Stars denote *** $p < 0.01$, ** $p < 0.05$ and * $p < 0.10$, using two-sided respondent-sandwich tests without multiplicity adjustment. The 95% intervals can include zero for single-star estimates.

Table C2. Components of the illustrative courthouse profile (Section 4.3 and Fig. 6). Standard errors in parentheses; stars as in Table C1

Component	Contribution in AUD
Courthouse (baseline)	30.59 (25.82)
Design cohort adjustment	-13.11 (12.36)
Age: 19th century	48.68*** (11.63)
Condition: Excellent	67.13*** (11.38)
Designation: Victorian	20.11** (8.85)
Access: public free	30.72*** (10.86)
Control of traffic	19.57** (7.62)
Distance: 10 km	23.56*** (8.98)
Scope: 1 place	1.39 (1.11)

The total is 228.63*** AUD (SE 24.36), 95% CI [180.88, 276.38], using the covariance of all components; adding the separate standard errors would be incorrect. The design-cohort adjustment averages over the weighted sample composition. The distance component is the difference between 10 km and the 100 km normalisation.

Appendix D. Complete model estimates

Table D1 reports all 62, 49 and 54 free parameters of the main Buildings, Historic Sites and Landscapes models; Table 2 in the article shows their common-attribute means. Table D2 reports all 107, 68 and 83 free parameters of the image models. In both, type coefficients are intercepts at reference common attributes and the coded distance normalisation (cohort 1 in the main models; the reference image, one place and cohort 2 in the image models). There is no additional estimated mean intercept, and the random preservation intercept has mean zero. All common attribute SDs and the preservation-intercept SD are estimated; type, cohort, image-interaction and cost SDs are fixed at zero. In the image models, type-by-image terms are the one-place contrasts shown in Fig. 4 and Table D3; image-by-scope terms change those contrasts for larger programmes.

Table D1. Full main-model estimates and diagnostics

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Type - Residential Building	-58.44** (25.72)	—	—	—	—	—
Type - Commercial/Retail Building	-55.16** (26.53)	—	—	—	—	—
Type - Industrial Building	-34.46 (26.20)	—	—	—	—	—
Type - Place of Worship	-35.56 (26.41)	—	—	—	—	—
Type - Hotel	22.73 (25.69)	—	—	—	—	—
Type - Hall	-32.71 (25.14)	—	—	—	—	—
Type - School/Education facility	-13.34 (24.92)	—	—	—	—	—
Type - Bank	-44.84* (25.44)	—	—	—	—	—
Type - Garden	12.39 (25.52)	—	—	—	—	—
Type - Transport Station	27.59 (25.55)	—	—	—	—	—
Type - Hospital	-30.72 (26.24)	—	—	—	—	—
Type - Police/Gaol	15.78 (26.08)	—	—	—	—	—

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Type - Post Office	24.01 (25.48)	—	—	—	—	—
Type - Courthouse	30.59 (25.82)	—	—	—	—	—
Type - Theatre	6.77 (26.83)	—	—	—	—	—
Type - Sports Centre	-96.61*** (26.45)	—	—	—	—	—
Type - Gallery	36.28 (26.66)	—	—	—	—	—
Type - Library	-8.57 (24.99)	—	—	—	—	—
Type - Settlement Site	—	—	-19.99 (24.98)	—	—	—
Type - Military Site	—	—	39.79** (20.29)	—	—	—
Type - Goldrush Site	—	—	17.36 (25.61)	—	—	—
Type - Mining Site	—	—	-65.84*** (20.70)	—	—	—
Type - Shipwreck	—	—	1.85 (20.24)	—	—	—
Type - Industrial/Mining Landscape	—	—	—	—	-138.84*** (25.28)	—
Type - Agricultural Landscape	—	—	—	—	-80.12*** (23.99)	—
Type - Residential Landscape	—	—	—	—	-78.74*** (22.95)	—
Type - Natural Landscape	—	—	—	—	-63.37*** (23.00)	—
Type - Trees	—	—	—	—	-11.97 (22.67)	—
Type - Bridge	—	—	—	—	9.46 (22.27)	—
Type - Wall	—	—	—	—	-80.48*** (23.03)	—
Type - Lighthouse	—	—	—	—	80.30*** (22.99)	—
Type - Roadway/Avenue	—	—	—	—	-61.56*** (23.88)	—

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Type - Pier/Wharf	—	—	—	—	-52.28** (22.72)	—
Age - 19th century (1803-1900)	48.68*** (11.63)	1.68 (5.34)	33.06*** (11.56)	80.19 (22.39)	87.42*** (12.90)	86.17 (32.78)
Age - Early 20th century (1901-18)	35.25*** (11.90)	50.44 (46.72)	20.33* (10.89)	3.97 (6.29)	40.67*** (11.82)	0.76 (2.00)
Age - Interwar period (1919-45)	22.98** (11.17)	0.12 (1.60)	24.26** (11.47)	30.72 (50.56)	10.00 (11.28)	0.33 (1.52)
Age - Post war (1946-70)	11.78 (10.92)	2.67 (2.53)	13.61 (10.75)	2.56 (4.48)	20.31* (11.36)	63.67 (40.57)
Condition - Excellent	67.13*** (11.38)	82.09 (30.09)	29.60*** (10.02)	82.23 (26.11)	40.67*** (9.99)	9.10 (50.55)
Condition - Good	30.59*** (10.67)	70.29 (32.09)	27.09*** (9.71)	52.12 (33.30)	33.04*** (10.04)	3.43 (5.34)
Condition - Poor	13.33 (9.96)	0.30 (8.97)	-5.90 (9.08)	4.37 (5.89)	7.11 (10.15)	53.53 (39.87)
Designation - National	-8.74 (9.26)	46.29 (38.35)	-9.38 (8.21)	28.06 (47.63)	2.83 (8.95)	67.70 (27.20)
Designation - Victorian	20.11** (8.85)	0.58 (4.35)	-16.63** (8.27)	38.34 (39.13)	-0.25 (8.72)	22.87 (71.91)
Development - All changes subject to approval	11.14 (9.18)	54.69 (36.17)	-6.61 (8.25)	60.99 (26.97)	-7.06 (8.87)	65.20 (28.70)
Development - Exterior subject to approval	25.60*** (9.45)	29.52 (84.57)	-21.27*** (8.16)	55.96 (27.85)	10.10 (8.48)	3.77 (8.16)
Control of visitation	6.14 (7.85)	105.12 (17.01)	25.29*** (6.80)	45.00 (24.56)	6.01 (6.87)	0.64 (1.03)
Control of traffic	19.57** (7.62)	30.59 (43.07)	24.68*** (6.76)	53.05 (23.14)	16.63** (7.27)	71.66 (20.84)
Control of noise	12.92* (7.41)	42.38 (32.21)	9.10 (6.86)	67.05 (19.10)	3.17 (6.94)	0.48 (2.01)
Security measures	9.73 (7.52)	55.38 (24.47)	-6.37 (6.58)	5.89 (14.79)	-2.75 (7.05)	1.11 (2.94)
Access - public free	30.72*** (10.86)	47.35 (46.05)	16.58* (9.11)	0.63 (1.72)	27.42*** (9.99)	5.21 (20.66)
Access - public with entry fee	16.73 (10.70)	59.96 (36.29)	39.15*** (9.53)	50.30 (33.56)	1.86 (10.17)	5.20 (12.41)
Access - commercial	31.99*** (10.43)	27.54 (43.90)	21.48** (9.38)	1.99 (2.35)	10.43 (10.41)	43.67 (49.35)
Distance (100 km)	-26.18*** (9.98)	36.65 (45.63)	19.10** (8.87)	44.83 (33.87)	-34.28*** (9.89)	3.93 (8.45)
Number of places (per 10)	13.88 (11.08)	2.80 (3.26)	-0.70 (11.13)	96.30 (36.17)	15.82 (11.98)	84.25 (39.81)

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Design cohort 2 vs 1	-18.82 (17.28)	—	10.28 (15.72)	—	-10.81 (15.59)	—
Design cohort 3 vs 1	-14.68 (16.62)	—	21.92 (14.67)	—	16.73 (14.66)	—
Cost coefficient per AUD 100 †	-1.242 (0.130)	—	-1.376 (0.134)	—	-1.113 (0.101)	—
Random preservation intercept †	0 (fixed)	166.96 (14.25)	0 (fixed)	151.45 (13.06)	0 (fixed)	158.55 (13.59)
Model diagnostics						
LL at convergence	-3,767.977		-3,884.356		-3,953.171	
LL at constant only	-4,360.325		-4,470.719		-4,465.041	
McFadden's pseudo-R^2	0.1358		0.1312		0.1146	
Ben-Akiva–Lerman fit index	0.5390		0.5207		0.5244	
Legacy panel fit index	0.5747		0.5611		0.5545	
AIC/n	1.1872		1.2193		1.2421	
BIC/n (choice count)	1.2523		1.2707		1.2988	
BIC/n (respondent count)	1.2390		1.2602		1.2872	
n (choices)	6,452		6,452		6,452	
r (respondents)	1,613		1,613		1,613	
k (free parameters)	62		49		54	

Notes: WTP is an individual one-off amount in 2017 AUD; respondent sandwich standard errors are in parentheses. Mean and SD columns are paired within each category; standard errors appear below estimates in parentheses. A dash denotes an absent coefficient or an SD fixed at zero. The random-intercept mean is fixed at zero. Mean attribute, type and cohort coefficients are in AUD; distance is per 100 km and scope per ten places. SDs use the units of the corresponding coefficient. Type intercepts refer to cohort 1 and reference characteristics, at zero programme size and the coded 100 km distance normalisation. Appendix C reports cohort-averaged components. The common random intercept has mean zero; all twenty common attribute slopes and the intercept have estimated SDs. Type, cohort and cost SDs are fixed at zero. The cost row is -100λ: the utility coefficient on payment in hundreds of AUD, with a delta-method standard error. It is not WTP; this reporting rescaling does not change the fit.

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$: two-sided normal Wald tests using respondent sandwich covariance. Stars are pointwise and unadjusted for multiplicity. † SDs and the sign-constrained cost coefficient receive no ordinary zero-null Wald stars. Zero is a boundary or limit of these parameters. Reported SD standard errors describe local curvature; near-zero components are weakly identified and are not interpreted as regular tests or confidence intervals. Absence of stars is not a finding of no effect.

Diagnostics: LL values use weights normalised to mean one. The constant-only comparator is a binary logit with one protection intercept on the same sample. McFadden's index is $1 - LL/LL_0$. The Ben-Akiva–Lerman index is the weighted mean marginal probability assigned to the observed choice, integrating over the random coefficients without conditioning on that person's choices. For comparison with the previous software output, the legacy panel index is $\text{mean}_i \exp(w_i \log L_i/4)$; this differs from the choice-level index. AIC/n = $(-2LL + 2k)/n$. The two BIC/n rows use $\log(n)k$ or $\log(r)k$ as the penalty; r is the number of independent respondent panels. Weighted information criteria are descriptive.

Table D2. Full image-model estimates and diagnostics

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Type - Residential Building	-88.25** (36.95)	—	—	—	—	—
Type - Commercial/Retail Building	-72.20 (51.87)	—	—	—	—	—
Type - Industrial Building	19.35 (50.87)	—	—	—	—	—
Type - Place of Worship	-3.85 (42.99)	—	—	—	—	—
Type - Hotel	24.49 (36.63)	—	—	—	—	—
Type - Hall	-80.21 (55.32)	—	—	—	—	—
Type - School/Education facility	7.07 (38.82)	—	—	—	—	—
Type - Bank	-30.41 (37.97)	—	—	—	—	—
Type - Garden	68.85* (36.90)	—	—	—	—	—
Type - Transport Station	57.96 (39.38)	—	—	—	—	—
Type - Hospital	24.89 (42.20)	—	—	—	—	—
Type - Police/Gaol	1.56 (36.57)	—	—	—	—	—
Type - Post Office	79.91** (39.71)	—	—	—	—	—
Type - Courthouse	74.97 (46.39)	—	—	—	—	—
Type - Theatre	-30.54 (37.62)	—	—	—	—	—
Type - Sports Centre	-137.08*** (46.85)	—	—	—	—	—
Type - Gallery	72.49* (41.29)	—	—	—	—	—
Type - Library	-14.33 (37.04)	—	—	—	—	—

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Type - Settlement Site	—	—	-128.79*** (45.70)	—	—	—
Type - Military Site	—	—	35.76 (32.71)	—	—	—
Type - Goldrush Site	—	—	-46.47 (44.58)	—	—	—
Type - Mining Site	—	—	-111.74*** (34.42)	—	—	—
Type - Shipwreck	—	—	-50.94 (35.87)	—	—	—
Type - Industrial/Mining Landscape	—	—	—	—	-202.58*** (48.75)	—
Type - Agricultural Landscape	—	—	—	—	-97.73* (52.64)	—
Type - Residential Landscape	—	—	—	—	-79.63* (45.67)	—
Type - Natural Landscape	—	—	—	—	-110.50*** (42.52)	—
Type - Trees	—	—	—	—	3.22 (47.72)	—
Type - Bridge	—	—	—	—	-56.08 (48.99)	—
Type - Wall	—	—	—	—	-85.73** (43.06)	—
Type - Lighthouse	—	—	—	—	45.64 (45.43)	—
Type - Roadway/Avenue	—	—	—	—	-8.31 (41.70)	—
Type - Pier/Wharf	—	—	—	—	-108.66** (47.54)	—
Age - 19th century (1803-1900)	68.37*** (15.77)	69.32 (37.29)	45.87*** (16.56)	85.75 (34.77)	102.81*** (20.08)	126.88 (44.19)

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Age - Early 20th century (1901-18)	31.22** (14.66)	47.91 (52.75)	33.21** (15.99)	6.61 (13.45)	54.40*** (18.77)	0.50 (1.99)
Age - Interwar period (1919-45)	8.66 (14.20)	0.92 (1.62)	45.88*** (16.57)	41.43 (69.95)	20.25 (17.42)	0.54 (2.96)
Age - Post war (1946-70)	17.07 (15.21)	2.40 (4.03)	17.21 (15.55)	26.14 (236.16)	11.86 (17.58)	103.38 (50.12)
Condition - Excellent	60.35*** (15.04)	87.04 (29.16)	74.29*** (15.95)	108.30 (31.23)	59.67*** (17.08)	50.74 (67.76)
Condition - Good	23.25* (13.32)	35.42 (51.75)	50.83*** (16.16)	83.10 (36.20)	36.36** (15.91)	0.42 (2.79)
Condition - Poor	0.71 (12.99)	7.94 (11.48)	16.63 (15.25)	2.94 (4.57)	9.30 (16.96)	58.55 (64.64)
Designation - National	-16.68 (11.49)	10.98 (39.17)	-23.12** (11.67)	7.88 (117.30)	14.37 (13.39)	56.50 (55.43)
Designation - Victorian	24.04** (11.82)	3.69 (42.05)	-20.42* (11.90)	5.53 (23.90)	0.38 (12.74)	18.06 (80.73)
Development - All changes subject to approval	11.90 (11.35)	15.09 (65.11)	-29.90*** (11.43)	41.71 (62.10)	-12.74 (14.74)	87.13 (41.03)
Development - Exterior subject to approval	22.25* (11.50)	42.20 (41.57)	-29.37*** (11.36)	74.86 (33.00)	10.97 (13.75)	21.08 (85.19)
Control of visitation	1.84 (9.43)	86.71 (20.07)	20.95** (9.47)	72.67 (28.50)	14.04 (10.98)	0.95 (2.72)
Control of traffic	13.32 (8.94)	2.51 (5.46)	23.18** (9.32)	77.37 (26.48)	3.09 (11.76)	88.35 (32.03)
Control of noise	5.04 (9.43)	49.44 (27.75)	11.54 (10.51)	61.08 (30.00)	16.60 (11.21)	1.44 (1.96)
Security measures	7.30 (9.74)	48.77 (28.26)	-3.08 (9.54)	6.34 (27.35)	1.43 (10.66)	2.59 (3.15)
Access - public free	29.48** (14.08)	52.97 (40.89)	53.44*** (13.82)	0.34 (5.91)	18.34 (15.40)	0.05 (2.64)
Access - public with entry fee	14.77 (12.68)	6.84 (19.97)	72.33*** (13.79)	12.59 (94.96)	7.58 (14.96)	5.31 (11.86)
Access - commercial	35.94*** (13.36)	52.04 (38.62)	31.35** (12.94)	0.16 (7.97)	14.19 (16.54)	92.40 (45.88)
Distance (100 km)	-31.09** (12.16)	12.97 (36.88)	14.69 (13.84)	35.04 (98.81)	-41.12** (16.68)	2.60 (6.36)
Places - 2 vs 1	-11.05 (24.31)	0.70 (2.93)	21.76 (21.70)	13.10 (132.81)	12.69 (29.00)	0.09 (31.03)

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Places - 5 vs 1	27.92 (22.42)	5.20 (7.01)	-15.86 (26.56)	2.19 (19.17)	-29.01 (26.01)	41.54 (68.95)
Places - 10 vs 1	30.50 (27.13)	0.82 (1.60)	1.84 (22.23)	0.59 (15.85)	32.55 (30.85)	15.03 (54.05)
Image alt x 2 places	20.53 (33.37)	—	-51.57 (35.71)	—	3.59 (41.56)	—
Image alt x 5 places	-26.38 (32.68)	—	-44.08 (39.21)	—	56.45 (39.87)	—
Image alt x 10 places	-36.55 (35.87)	—	7.41 (34.07)	—	1.77 (44.49)	—
Image none x 2 places	4.09 (37.36)	—	9.35 (32.68)	—	19.81 (39.92)	—
Image none x 5 places	-33.70 (33.60)	—	34.73 (38.73)	—	55.53 (36.92)	—
Image none x 10 places	7.31 (37.30)	—	15.69 (34.52)	—	-18.06 (40.07)	—
Design cohort 3 vs 2	0.72 (12.45)	—	12.89 (14.26)	—	39.50** (16.56)	—
Cost coefficient per AUD 100 †	-1.341 (0.169)	—	-1.168 (0.153)	—	-0.930 (0.131)	—
Type - Residential Building x Alternative image	53.18 (46.63)	—	—	—	—	—
Type - Commercial/Retail Building x Alternative image	58.56 (61.25)	—	—	—	—	—
Type - Industrial Building x Alternative image	-63.39 (55.76)	—	—	—	—	—
Type - Place of Worship x Alternative image	21.22 (50.87)	—	—	—	—	—
Type - Hotel x Alternative image	-12.86 (53.98)	—	—	—	—	—
Type - Hall x Alternative image	93.02 (60.40)	—	—	—	—	—
Type - School/Education facility x Alternative image	-1.14 (54.02)	—	—	—	—	—
Type - Bank x Alternative image	-9.48 (49.51)	—	—	—	—	—

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Type - Garden x Alternative image	-122.16*** (45.34)	—	—	—	—	—
Type - Transport Station x Alternative image	10.39 (46.46)	—	—	—	—	—
Type - Hospital x Alternative image	-52.01 (45.88)	—	—	—	—	—
Type - Police/Gaol x Alternative image	22.46 (47.52)	—	—	—	—	—
Type - Post Office x Alternative image	-71.42 (47.90)	—	—	—	—	—
Type - Courthouse x Alternative image	-6.23 (55.49)	—	—	—	—	—
Type - Theatre x Alternative image	80.22* (46.18)	—	—	—	—	—
Type - Sports Centre x Alternative image	69.56 (52.95)	—	—	—	—	—
Type - Gallery x Alternative image	-100.04* (51.52)	—	—	—	—	—
Type - Library x Alternative image	-12.39 (53.94)	—	—	—	—	—
Type - Residential Building x No image	20.22 (49.72)	—	—	—	—	—
Type - Commercial/Retail Building x No image	-19.09 (55.65)	—	—	—	—	—
Type - Industrial Building x No image	-107.69* (56.36)	—	—	—	—	—
Type - Place of Worship x No image	-84.75* (50.00)	—	—	—	—	—
Type - Hotel x No image	-27.29 (46.00)	—	—	—	—	—
Type - Hall x No image	-29.97 (61.30)	—	—	—	—	—
Type - School/Education facility x No image	-80.37* (46.00)	—	—	—	—	—
Type - Bank x No image	-58.68 (52.86)	—	—	—	—	—

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Type - Garden x No image	-115.48** (48.30)	—	—	—	—	—
Type - Transport Station x No image	-72.75 (52.54)	—	—	—	—	—
Type - Hospital x No image	-130.00** (60.02)	—	—	—	—	—
Type - Police/Gaol x No image	7.77 (50.94)	—	—	—	—	—
Type - Post Office x No image	-134.62*** (49.80)	—	—	—	—	—
Type - Courthouse x No image	-127.43** (52.80)	—	—	—	—	—
Type - Theatre x No image	4.38 (54.08)	—	—	—	—	—
Type - Sports Centre x No image	14.92 (56.39)	—	—	—	—	—
Type - Gallery x No image	-72.53 (53.24)	—	—	—	—	—
Type - Library x No image	15.51 (48.07)	—	—	—	—	—
Type - Settlement Site x Alternative image	—	—	72.97 (56.31)	—	—	—
Type - Military Site x Alternative image	—	—	-61.27** (28.61)	—	—	—
Type - Goldrush Site x Alternative image	—	—	73.47 (47.97)	—	—	—
Type - Mining Site x Alternative image	—	—	77.39** (31.79)	—	—	—
Type - Shipwreck x Alternative image	—	—	64.08* (35.10)	—	—	—
Type - Settlement Site x No image	—	—	190.82*** (54.79)	—	—	—
Type - Military Site x No image	—	—	-49.96 (32.18)	—	—	—
Type - Goldrush Site x No image	—	—	-41.89 (53.95)	—	—	—

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Type - Mining Site x No image	—	—	9.22 (28.61)	—	—	—
Type - Shipwreck x No image	—	—	31.66 (30.79)	—	—	—
Type - Industrial/Mining Landscape x Alternative image	—	—	—	—	-25.02 (50.36)	—
Type - Agricultural Landscape x Alternative image	—	—	—	—	0.26 (53.01)	—
Type - Residential Landscape x Alternative image	—	—	—	—	-78.28 (48.63)	—
Type - Natural Landscape x Alternative image	—	—	—	—	33.12 (47.94)	—
Type - Trees x Alternative image	—	—	—	—	-90.08* (51.26)	—
Type - Bridge x Alternative image	—	—	—	—	60.21 (51.67)	—
Type - Wall x Alternative image	—	—	—	—	-46.74 (46.13)	—
Type - Lighthouse x Alternative image	—	—	—	—	73.84 (54.63)	—
Type - Roadway/Avenue x Alternative image	—	—	—	—	-151.34*** (47.51)	—
Type - Pier/Wharf x Alternative image	—	—	—	—	-64.78 (48.53)	—
Type - Industrial/Mining Landscape x No image	—	—	—	—	56.63 (47.79)	—
Type - Agricultural Landscape x No image	—	—	—	—	-1.99 (52.66)	—
Type - Residential Landscape x No image	—	—	—	—	-82.90* (48.66)	—
Type - Natural Landscape x No image	—	—	—	—	-40.82 (49.82)	—
Type - Trees x No image	—	—	—	—	-127.12** (49.61)	—
Type - Bridge x No image	—	—	—	—	-0.72 (48.49)	—

Parameter	Buildings		Historic Sites		Landscapes	
	Mean	SD †	Mean	SD †	Mean	SD †
Type - Wall x No image	—	—	—	—	-13.12 (47.16)	—
Type - Lighthouse x No image	—	—	—	—	-34.21 (46.20)	—
Type - Roadway/Avenue x No image	—	—	—	—	-195.26*** (52.62)	—
Type - Pier/Wharf x No image	—	—	—	—	32.31 (48.49)	—
Random preservation intercept †	0 (fixed)	161.00 (15.55)	0 (fixed)	178.28 (20.91)	0 (fixed)	207.58 (27.00)
Model diagnostics						
LL at convergence	-2,947.536		-3,089.039		-3,110.636	
LL at constant only	-3,463.398		-3,543.450		-3,539.456	
McFadden's pseudo-R^2	0.1489		0.1282		0.1212	
Ben-Akiva–Lerman fit index	0.5452		0.5189		0.5237	
Legacy panel fit index	0.5798		0.5597		0.5578	
AIC/n	1.1941		1.2342		1.2485	
BIC/n (choice count)	1.3309		1.3211		1.3546	
BIC/n (respondent count)	1.3019		1.3027		1.3321	
n (choices)	5,116		5,116		5,116	
r (respondents)	1,279		1,279		1,279	
k (free parameters)	107		68		83	

Notes: Parameter units, cost rescaling, dash notation and standard errors follow Table D1.
*** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$: two-sided normal Wald tests using respondent sandwich covariance. Stars are pointwise and unadjusted for multiplicity. † SDs and the sign-constrained cost coefficient receive no ordinary zero-null Wald stars. Zero is a boundary or limit of these parameters. Reported SD standard errors describe local curvature; near-zero components are weakly identified and are not interpreted as regular tests or confidence intervals. Absence of stars is not a finding of no effect.

Diagnostics follow the definitions beneath Table D1 and are recalculated on the image-analysis sample.

Table D3. Image contrasts in AUD for a one-place programme (Fig. 4)

Asset type	Alternative minus reference Estimate [95% CI]	No image minus reference Estimate [95% CI]
Buildings		
Residential Building	53.2 [-38.2, 144.6]	20.2 [-77.2, 117.7]
Commercial/Retail Building	58.6 [-61.5, 178.6]	-19.1 [-128.2, 90.0]
Industrial Building	-63.4 [-172.7, 45.9]	-107.7* [-218.2, 2.8]
Place of Worship	21.2 [-78.5, 120.9]	-84.7* [-182.7, 13.2]
Hotel	-12.9 [-118.7, 92.9]	-27.3 [-117.4, 62.9]
Hall	93.0 [-25.4, 211.4]	-30.0 [-150.1, 90.2]
School/Education facility	-1.1 [-107.0, 104.7]	-80.4* [-170.5, 9.8]
Bank	-9.5 [-106.5, 87.6]	-58.7 [-162.3, 44.9]
Garden	-122.2*** [-211.0, -33.3]	-115.5** [-210.2, -20.8]
Transport Station	10.4 [-80.7, 101.4]	-72.8 [-175.7, 30.2]
Hospital	-52.0 [-141.9, 37.9]	-130.0** [-247.6, -12.4]
Police/Gaol	22.5 [-70.7, 115.6]	7.8 [-92.1, 107.6]
Post Office	-71.4 [-165.3, 22.5]	-134.6*** [-232.2, -37.0]
Courthouse	-6.2 [-115.0, 102.5]	-127.4** [-230.9, -23.9]
Theatre	80.2* [-10.3, 170.7]	4.4 [-101.6, 110.4]
Sports Centre	69.6 [-34.2, 173.3]	14.9 [-95.6, 125.4]
Gallery	-100.0* [-201.0, 0.9]	-72.5 [-176.9, 31.8]
Library	-12.4 [-118.1, 93.3]	15.5 [-78.7, 109.7]
Historic Sites		
Settlement Site	73.0 [-37.4, 183.3]	190.8*** [83.4, 298.2]
Military Site	-61.3** [-117.3, -5.2]	-50.0 [-113.0, 13.1]
Goldrush Site	73.5 [-20.6, 167.5]	-41.9 [-147.6, 63.8]
Mining Site	77.4** [15.1, 139.7]	9.2 [-46.9, 65.3]
Shipwreck	64.1* [-4.7, 132.9]	31.7 [-28.7, 92.0]
Landscapes		

Asset type	Alternative minus reference Estimate [95% CI]	No image minus reference Estimate [95% CI]
Industrial/Mining Landscape	-25.0 [-123.7, 73.7]	56.6 [-37.0, 150.3]
Agricultural Landscape	0.3 [-103.6, 104.2]	-2.0 [-105.2, 101.2]
Residential Landscape	-78.3 [-173.6, 17.0]	-82.9* [-178.3, 12.5]
Natural Landscape	33.1 [-60.8, 127.1]	-40.8 [-138.5, 56.8]
Trees	-90.1* [-190.5, 10.4]	-127.1** [-224.4, -29.9]
Bridge	60.2 [-41.1, 161.5]	-0.7 [-95.8, 94.3]
Wall	-46.7 [-137.2, 43.7]	-13.1 [-105.6, 79.3]
Lighthouse	73.8 [-33.2, 180.9]	-34.2 [-124.8, 56.4]
Roadway/Avenue	-151.3*** [-244.5, -58.2]	-195.3*** [-298.4, -92.1]
Pier/Wharf	-64.8 [-159.9, 30.3]	32.3 [-62.7, 127.4]

Notes: Each category uses 1,279 respondents and 5,116 choices, with normal random common attributes and preservation intercept, a fixed negative cost coefficient, scope indicators, all image-by-scope interactions and one design-cohort intercept. Type-image shifts and image-scope interactions are fixed mean effects. Contrasts for two, five and ten places add the relevant image-scope coefficient. All contrasts use the full respondent sandwich covariance.

Stars denote two-sided tests using respondent sandwich covariance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Intervals are pointwise 95% intervals, so a single-star estimate can have an interval containing zero. Individual contrasts are not adjusted for multiple comparisons. Complete image-model estimates and fit diagnostics appear in Appendix D; category-level joint tests provide the primary summary.



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