WDNE GLOBAL CODING rev 6

Codes

Codes\\GT CODES (Basic level - Inductive - Specific)

First level of Inductive analysis / this is the capillary coding and the emergence of the building blocks at the most literal level of correspondence between data and coding. These are clustered into a coding tree with hierarchical levels of abstraction. However they remain descriptive, synthetic and tag-like

| Name | Description | Files | References |
| --- | --- | --- | --- |
| 3D PRINTING - ADDITIVE MANUFACTURING | General Category code for clustering the various aspects specifically related to AM that are emerging from the interviews | 23 | 591 |
| ADAPTATION - ADOPTION OF 3D PRINTING |  | 2 | 3 |
| ADVANTAGES - POSITIVES |  | 17 | 43 |
| AM CONSULTANT | a new role that stands between a design constultant and an AM Designer, it is somebody that helps others to optimise the choices and the passages that are required to develop a product intended for AM. The client wants to develop that product but does not know what is the most suitable design for it, but also what is the best printing technology, material etc. This is what this role is about. | 1 | 5 |
| ARTICULATED PRINTS - CHAINS - LINKS |  | 4 | 17 |
| BETTER PRODUCTS THROUGH QUICKER VALIDATION |  | 1 | 1 |
| BUREAU - OUTSOURCING |  | 10 | 17 |
| CERTIFICATIONS - COPYRIGHT - STANDARDS - BUREAUCRACY |  | 4 | 8 |
| CODING |  | 2 | 3 |
| CONCERNS ABOUT 3D PRINTING |  | 1 | 7 |
| COST |  | 11 | 21 |
| CUSTOMISATION |  | 8 | 23 |
| DESKTOP PRINTER |  | 7 | 11 |
| DEVELOPMENT OF TECHNOLOGY |  | 1 | 1 |
| DIGITAL MOCKUPS - SIMULATIONS |  | 3 | 5 |
| DIGITAL STOCK |  | 1 | 1 |
| DISADVANTAGES - NEGATIVES |  | 8 | 18 |
| FDM PRINTER |  | 9 | 13 |
| FDR PRINTER |  | 1 | 3 |
| FINDING USES-APPLICATIONS FOR AM INNOVATIONS |  | 3 | 11 |
| FIRST APPROACHES WITH AM |  | 9 | 16 |
| FOR MOLDMAKING |  | 1 | 2 |
| FOR PRODUCING THE PRODUCTION PARTS |  | 1 | 2 |
| FOR PRODUCT VALIDATION |  | 1 | 4 |
| FOR PRODUCTION |  | 15 | 31 |
| FOR PROTOTYPING - MODELMAKING - MOCKUPS |  | 17 | 46 |
| HIGH TEMP PLA |  | 1 | 1 |
| INDEPENDENCE - FREEDOM |  | 2 | 4 |
| INFILL |  | 1 | 1 |
| IN-HOUSE - OWN PRINTER |  | 10 | 11 |
| INNOVATION |  | 11 | 24 |
| ITERATIONS |  | 4 | 9 |
| KNOWLEDGE OF PRINTING TECHNOLOGY |  | 6 | 14 |
| MADE TO ORDER - PRINT ON DEMAND |  | 4 | 6 |
| MASS PRODUCTION - LARGE QUANTITIES |  | 8 | 11 |
| METAL 3D PRINTING |  | 3 | 3 |
| MULTI JET FUSION |  | 2 | 2 |
| NEW JOBS AND SKILLS |  | 2 | 2 |
| PELLET EXTRUSION |  | 1 | 1 |
| POWDER |  | 4 | 4 |
| PRINTING FOR - WITH MATERIALS |  | 7 | 29 |
| PRINTING DIMENSIONS |  | 5 | 12 |
| PUSHING AM FORWARD |  | 5 | 31 |
| PUSHING THE BOUNDARIES OF DESIGN |  | 5 | 14 |
| REMOTE WORK |  | 1 | 4 |
| RESIN |  | 3 | 3 |
| SCALE - TOLERANCES |  | 4 | 6 |
| SLS PRINTER |  | 9 | 14 |
| SMALL PRODUCTION - NICHE |  | 10 | 18 |
| SPEED |  | 8 | 17 |
| STEREOLITHOGRAPHY |  | 1 | 1 |
| TECHNICAL CONSTRAINTS |  | 6 | 9 |
| TECHNOLOGY OF CHOICE |  | 4 | 5 |
| TPU |  | 2 | 2 |
| WHAT CAN BE ONLY DONE WITH AM OR THROUGH CAD |  | 5 | 7 |
| WHAT CAN BE PRINTED AND WHAT CANNOT |  | 8 | 14 |
| BACKGROUND | talking about the upbringing/studies/education/influences/whatever is before or behind their approach to product/industrial design | 23 | 142 |
| CHILDHOOD INTERESTS - HOBBYS - PASSIONS |  | 21 | 32 |
| EXPERTISE |  | 4 | 8 |
| FAMILY - UPBRINGING | Talking about a family member or family business or tradition or habits connected to childhood, all in relationship with background | 13 | 15 |
| PREVIOUS WORK EXPERIENCE |  | 13 | 25 |
| EMPLOYEE |  | 11 | 14 |
| STUDIO ENGINEER |  | 1 | 3 |
| INTERNSHIP |  | 2 | 2 |
| SELF-EMPLOYED - CONSULTANT - ENTEPRENEUR |  | 6 | 9 |
| REASONS FOR SWITCHING TO DESIGN |  | 4 | 11 |
| STUDIES |  | 23 | 47 |
| 3D Design |  | 2 | 2 |
| 3D Printing |  | 2 | 2 |
| Architecture |  | 1 | 2 |
| BIology - Science |  | 1 | 1 |
| Biomedical Engineering |  | 1 | 1 |
| Chemical Engineering |  | 1 | 1 |
| Crafts |  | 2 | 2 |
| Design Technology |  | 3 | 3 |
| Education Studies |  | 1 | 1 |
| Engineering |  | 4 | 4 |
| Fine Art |  | 2 | 2 |
| Industrial Design |  | 9 | 11 |
| Jewellery and Metalwork |  | 1 | 1 |
| Materials Science (Recycling TPU) |  | 1 | 1 |
| Mechanical Engineering |  | 2 | 2 |
| Photography-Videography |  | 0 | 0 |
| Product Design |  | 6 | 6 |
| Textile Design |  | 3 | 3 |
| Transport Design |  | 2 | 2 |
| YEARS IN THE BUSINESS | how many years the interviewee, or the studio or the company has been working in the specific field of AM or Product/Industrial design | 3 | 4 |
| CHANGES BETWEEN OLD AND NEW | Referred to comments where specifically old situations, methods, approaches are compared with how things have changed and become now, with the new technologies. | 5 | 14 |
| CLIENTS | general category referred to all discourses related to the customers/clients etc with which the interviewee is interfaced when working on a project | 15 | 85 |
| HOW CLIENTS - WORK - PROJECTS ARE FOUND | Code related to how new commissions/jobs/projects are assigned to the interviewee - through which channels, how the deal was found. | 7 | 8 |
| RELATIONSHIP WITH CLIENTS | referred to all the comments where the interviewee mentions the Client as a variable upon which certain aspects of the design process might depend. | 13 | 48 |
| TYPES OF CLIENTS | code referred to clients in terms of big/small companies, or infividual clients. Same criterion as for 'company dimensions' category, but in this case the distinction relates to the clients | 6 | 27 |
| 3D PRINTING COMPANY |  | 1 | 1 |
| BIG COMPANY | Structured, big company and all subsequent and related comments, about characteristics and traits of big companies as clients for the interviewee | 2 | 11 |
| CONSUMER GOOD COMPANIES |  | 1 | 1 |
| EDUCATIONAL |  | 2 | 4 |
| RESEARCH INSITUTIONS |  | 1 | 1 |
| SMALL CLIENTS | Similar distinction as in the codes for 'company dimensions' but in this case related to the type of customers. Single customers, or very small companies, acting as clients for the interviewee | 1 | 6 |
| ENTEPRENEURS | small companies or even individuals running a business, relatively small, for which the interviewee is developing a project | 1 | 1 |
| INVENTORS | sub-code for specifying a type of small client, generally an indivisual or a very small business for which the interviewee is developing a project | 1 | 1 |
| WHO DECIDES THE PROJECT |  | 1 | 2 |
| COMPANY DIMENSIONS | General category for comments where there is a mention to the dimensions of a company, in terms of employees or structure, or 'weight' in the business, | 5 | 9 |
| BIG COMPANY | not strictly dependent on specific numbers of employees, but mainly referred to what the interviewees define as 'big companies' | 3 | 3 |
| SMALL COMPANY | solo/ two, three/ four people, or most likely dependant on how the interviewee defines their business, as a 'small' company. | 2 | 5 |
| DESIGN ASPECTS | General category code for various aspects related to design, more in general. Some might also apply to AM, but they are not so technically or specifically referred to it so I have kept them separate for the moment | 23 | 1108 |
| ADVANTAGES OF NEW TECHNOLOGIES | Coments and thoughts about the benefits of new technologies | 10 | 26 |
| AESTHETICS - STYLE - VISUAL ASPECT | Focus on the visual, aesthetically pleasing side of design | 12 | 32 |
| AI |  | 10 | 31 |
| ART vs TECHNOLOGY |  | 4 | 13 |
| BEING AT THE CUTTING-EDGE |  | 2 | 3 |
| BIG BRANDS vs INDEPENDENT DESIGNERS-CREATORS |  | 2 | 3 |
| BIOMECHANICS |  | 1 | 2 |
| BREAKING THE RULES - GOING AGAINST THE TIDE |  | 4 | 10 |
| BUDGET - COST |  | 10 | 23 |
| BUSINESS STRATEGY |  | 3 | 6 |
| CLIENT FIXATIONS |  | 1 | 3 |
| CO-CREATION |  | 6 | 17 |
| COLOUR - COLOURING |  | 2 | 4 |
| COMMUNICATION - STORYTELLING |  | 8 | 21 |
| COMMUNITY - SHARING |  | 7 | 24 |
| COMPETITORS PRODUCTS |  | 1 | 1 |
| COMPLEXITY - SIMPLICITY |  | 2 | 2 |
| COMPUTATIONAL DESIGN | comments related to designing using computers, software and aspects specific to computational design | 7 | 22 |
| CONTRAST BETWEEN AESTHETICS vs FUNCTIONALITY |  | 12 | 24 |
| COPYRIGHT - LICENSING |  | 3 | 6 |
| CRAFT INTEGRATION |  | 6 | 17 |
| CREATIVITY- MAKE IT DIFFERENT - NEED FOR NOVELTY |  | 14 | 37 |
| CRITICAL THINKING |  | 5 | 13 |
| DATA-BASED DESIGN |  | 7 | 21 |
| DEMOCRATISATION OF DESIGN |  | 7 | 14 |
| DESIGN FOR AM |  | 10 | 22 |
| DESIGN PHILOSOPHY | Their sense of what Design should be, should do, or what they think the meaning of a product should be, or their view on what good or bad design is | 2 | 20 |
| DESIGN THINKING |  | 2 | 4 |
| DESIGNER EXPERIENCE |  | 10 | 19 |
| DESIGNER'S INTUITION |  | 9 | 18 |
| DESIGNERS SKILLS |  | 8 | 25 |
| DESIGNING - THE ART OF CREATING | Focus on the creative, artistic side of design | 2 | 3 |
| DESIGNING THROUGH MAKING |  | 3 | 6 |
| DISADVANTAGES OF NEW TECHNOLOGIES |  | 2 | 12 |
| DIY |  | 1 | 2 |
| ECLECTICSM - VERSATILITY | a multifaceted knowledge that gives breadth to the designer's abilities, allowing to switch confidently between different ambits, tools or environments, and expanding technical and creative possibilities, like owning a complete and heterogeneous 'toolbox' of resources | 3 | 12 |
| EFFICIENCY |  | 4 | 4 |
| EGO - STARDOM - VANITY |  | 3 | 5 |
| ELASTICITY- STIFFNESS - FLEXIBILITY - ARTICULATION |  | 6 | 10 |
| EMOTION |  | 2 | 4 |
| END TO END INVOLVMENT | The ability, possibility or capacity of the designer to be involved into the entire design process from start to finish, from the idea generation and development to the manufacturing of the final product | 7 | 11 |
| EXHIBITING - PUBLISHING |  | 1 | 1 |
| EXPLORATION |  | 8 | 30 |
| FORM FROM TECHNOLOGY | A new technology, a new form. From Patrick Jouin quote, each new technology inspires design to go in directions that are only made possible by that technology | 3 | 6 |
| FUNCTIONALITY |  | 4 | 6 |
| GEOMETRY - TRIGONOMETRY - ERGONOMICS - MATHEMATICS - CALCULUS - ENGINEERING KNOWLEDGE |  | 5 | 9 |
| GIVING AN EXPERIENCE TO THE CUSTOMER |  | 2 | 7 |
| HONESTY, CLARITY, FEASIBILITY |  | 1 | 3 |
| HUMAN TOUCH \_ UNIQUENESS |  | 4 | 10 |
| IMPERFECTION - MISTAKES- CHANCE |  | 5 | 11 |
| INNOVATION | focus on experimentation and innovation, pushing boundaries, setting new limits | 5 | 6 |
| INSPIRATION |  | 6 | 10 |
| INVOLUTION OF DESIGN INNOVATION |  | 1 | 1 |
| LIAISING WITH THE MANUFACTURERS or EXTERNAL EXPERTS |  | 12 | 27 |
| MANUALITY - HANDMAKING |  | 7 | 11 |
| MANUFACTURING - MANUFACTURABILITY | Focus on the feasibility of design - how it can be successfully translated into a real manufacturable product | 14 | 37 |
| MATERIALS - FINISHES - COLOURING |  | 16 | 33 |
| MIMICKING NATURE OR NON-3D PRINTING |  | 4 | 15 |
| OBSESSION |  | 1 | 1 |
| PACKAGING |  | 6 | 8 |
| PERFORMANCE | similar to technical focus, it is a scientifically-based approach that focuses on achieving performance/functionality as the main goal | 3 | 4 |
| PERFORMANCE - PHYSICS CONSTRAINTS | Design dependent on performance requirements - physics constraints - efficiency - specific parameters | 6 | 11 |
| PRECISION - DETAIL |  | 2 | 2 |
| PROBLEM SOLVING |  | 5 | 8 |
| PROMOTION - MARKETING |  | 3 | 6 |
| QUALITY |  | 2 | 2 |
| R&D |  | 3 | 5 |
| REMANUFACTURING |  | 1 | 1 |
| RETAIL - SALES |  | 1 | 2 |
| REUSING GEOMETRIES - FILES |  | 3 | 4 |
| SCALE - MEASURES - TOLERANCES |  | 10 | 22 |
| SCIENCE-RESEARCH-BASED |  | 6 | 10 |
| SIMULATIONS - GENERATIVE DESIGN - FEA |  | 6 | 12 |
| SKETCHING - DRAWING |  | 1 | 1 |
| SOCIAL IMPACT - ETHICS | the abiliti to influence society, involve people or communities, educate people or give a voice to people or designers, a social impact in a variety of forms | 2 | 2 |
| SPECULATIVE DESIGN |  | 1 | 3 |
| STANDARDISATION |  | 2 | 6 |
| STRENGHT |  | 3 | 3 |
| STRUCTURE |  | 9 | 28 |
| CHAIN MAIL |  | 3 | 5 |
| GRID |  | 1 | 1 |
| LATTICE STRUCTURES |  | 4 | 8 |
| MESHES |  | 4 | 7 |
| NURBS |  | 1 | 4 |
| SUSTAINABILITY - ENVIRONMENTAL ASPECTS |  | 17 | 49 |
| TACIT KNOWLEDGE |  | 0 | 0 |
| TACTILITY - SENSORIALITY - MATERIALITY |  | 7 | 13 |
| TEAM WORK - COLLABORATION |  | 12 | 38 |
| TECHNICAL DESIGN | referred to the technical side of design | 1 | 7 |
| TECHNOLOGICAL SKILLS (TECHNICAL SKILLS) |  | 1 | 1 |
| TERMINOLOGY - WORDING - LANGUAGE |  | 1 | 3 |
| TIME CONSTRAINTS |  | 2 | 3 |
| TRIAL AND ERROR |  | 5 | 9 |
| USERS EXPERIENCE - CUSTOMER FACING - HUMAN CENTRIC DESIGN | all aspects rotating around the user, including impairments or disabilities. UX, UI etc | 13 | 45 |
| VARIETY OF DESIGN PROJECTS | focus on the eclecticism of design / the possibility to get in contact with very diverse working fields and environments | 1 | 1 |
| VR |  | 2 | 5 |
| WEIGHT |  | 3 | 7 |
| WELLBEING |  | 5 | 9 |
| WORKING STYPE - APPROACH |  | 1 | 2 |
| DESIGN PROCESS | Main category related to all the stages/phases of the design process, from start to finished product . This refers together to traditional and AM designers, so that they might be grouped under the same nodes and differences might be gathered by a direct comparison of what they say about the same or similar topic | 23 | 373 |
| BRAINSTORMING |  | 1 | 2 |
| BRIEF | Design brief - a series of requirements specified or agreed with a client (or even set for themselves) around which the design process will develop | 8 | 16 |
| CONCEPT DEVELOPMENT |  | 5 | 10 |
| DESIGN FOR MANUFACTURING |  | 6 | 26 |
| DESIGN PROBLEM |  | 4 | 5 |
| DESIGNING - DRAWING | Main code grouping all specifications and comments related to the stage of drawing and designing with various techniques and criteria | 0 | 0 |
| PARAMETRIC MODELLING |  | 6 | 14 |
| RENDERING - VISUALISATION |  | 11 | 24 |
| SKETCHING - DRAWING |  | 17 | 40 |
| SOFTWARE |  | 23 | 131 |
| 2D Software |  | 4 | 7 |
| COREL DRAW |  | 1 | 1 |
| FIGMA |  | 1 | 1 |
| ILLUSTRATOR |  | 2 | 2 |
| PHOTOSHOP |  | 2 | 3 |
| 3D Printing |  | 8 | 11 |
| 3MATIC by MATERIALISE |  | 1 | 2 |
| 3MF |  | 1 | 2 |
| CURA |  | 2 | 2 |
| MAGICS |  | 1 | 1 |
| PRUSA |  | 2 | 2 |
| SLICING SOFTWARE (Unspecified) |  | 1 | 1 |
| ULTIMAKER SLICER SOFTWARE |  | 1 | 1 |
| Architecture |  | 1 | 3 |
| AUTOCAD |  | 1 | 1 |
| BEAM for RHINO (REVIT) |  | 1 | 1 |
| REVIT |  | 1 | 1 |
| CAD (generic) |  | 11 | 26 |
| Computational |  | 8 | 21 |
| GRASSHOPPER |  | 7 | 10 |
| HYPERGANIC |  | 1 | 1 |
| NTOPOLOGY |  | 3 | 4 |
| RHINO COMPUTE |  | 1 | 1 |
| TOPOLOGY OPTIMIZATION |  | 3 | 5 |
| Gaming and Movie Industry |  | 9 | 21 |
| 3D STUDIO MAX |  | 2 | 2 |
| BLENDER |  | 5 | 9 |
| GAMING DESIGN SOFTWARE |  | 1 | 2 |
| HOUDINI |  | 3 | 3 |
| MAYA |  | 1 | 2 |
| UNKNOWN MESHING ALGORHYTHM |  | 1 | 2 |
| ZBRUSH |  | 1 | 1 |
| Product Design |  | 14 | 36 |
| ALIAS STUDIO TOOLS |  | 1 | 1 |
| CREO |  | 1 | 1 |
| FUSION 360 |  | 3 | 3 |
| RHINO |  | 11 | 20 |
| SOLIDWORKS |  | 6 | 9 |
| TSPLINES |  | 1 | 2 |
| Rendering |  | 2 | 4 |
| KEYSHOT |  | 2 | 3 |
| VRAY |  | 1 | 1 |
| Simulation |  | 1 | 2 |
| MSC MARC |  | 1 | 1 |
| MSC SCFLOW |  | 1 | 1 |
| SURFACE MODELING |  | 3 | 6 |
| TECHNICAL DRAWING |  | 1 | 1 |
| EVALUATION - MODIFICATION | Stage od advanced design development where models are evaluated and modified for further refinement | 10 | 19 |
| FEEDBACK |  | 7 | 20 |
| GENERAL SUMMARY OF DESIGN STAGES | Code for comments where the interviewee summarises in a sentence or a paragraph the various stages he/she goes through in the design process | 21 | 45 |
| ITERATIONS |  | 8 | 22 |
| MODELMAKING - MOCKUPS |  | 15 | 29 |
| MOODBOARDS |  | 2 | 3 |
| PRELIMINARY RESEARCH | preliminary stage of the design process where research of various kinds is performed in order to inform the development of new ideas | 14 | 63 |
| CONSUMER RESEARCH |  | 4 | 16 |
| FUTURE & FORESIGHT |  | 1 | 1 |
| MARKET RESEARCH |  | 5 | 8 |
| RESEARCH BUDGET | referred to comments where a specific budget is allocated for conducting preliminary research | 1 | 4 |
| VISUAL ARCHIVE |  | 2 | 2 |
| WORKSHOPS |  | 2 | 4 |
| PRODUCTION - MANUFACTURING |  | 1 | 3 |
| PROJECT DOCUMENTATION | keeping a product timeline or keeping notes, lists, instructions, written notes, memos documenting the various stages or passages in a project | 1 | 8 |
| PROTOTYPING |  | 13 | 49 |
| REVERSE ENGINEERING |  | 2 | 3 |
| SAMPLING - TESTING | Stage of preliminary research where ideas are tried and tested in various ways | 9 | 17 |
| STAGES OF DESIGN DEVELOPMENT |  | 9 | 17 |
| 'TRADITIONAL DESIGN PROCESS' | code grouping all comments where there is a reference to a 'traditional design process' in opposition to what they instead do | 7 | 16 |
| EDUCATION | General Category referred to Institutional Education, possible avenues for future training of students, courses, etc. | 15 | 31 |
| EDUCATING THE PUBLIC |  | 1 | 2 |
| STUDENTS SKILLS |  | 9 | 16 |
| FUTURE | This code groups all comments made to the question abour where AM is headed or where their AM practice is headed, so it is about their perception about future developments - Sometimes can be overlap with discourses about VR or AI and these are codes contained in DESIGN ASPECTS - possibility to copy them here too or to merge later, if necessary | 12 | 26 |
| OTHER MANUFACTURING TECHNOLOGIES | CNC machining - Injection molding etc | 3 | 4 |
| CNC MACHINING |  | 2 | 4 |
| INJECTION MOLDING |  | 4 | 7 |
| PROJECT EXAMPLES | Each interview contains one initial, common question about the description of one project in order to capture the process. This general category code is grouping the main fields in which these projects have been developed. | 21 | 66 |
| ANIMAL PROSTHETICS |  | 1 | 3 |
| ART- COLLECTIBLE DESIGN |  | 1 | 4 |
| CAR DESIGN |  | 1 | 1 |
| CARBON CAPTURE |  | 1 | 1 |
| DISHWASHER LOADER |  | 1 | 1 |
| DOOR HANDLE |  | 1 | 1 |
| FASHION - SPORTS |  | 6 | 10 |
| 3D PRINTED FABRIC |  | 2 | 3 |
| FOOTWEAR |  | 3 | 4 |
| TEXTILE PRINT |  | 1 | 1 |
| FIRE PIT |  | 1 | 1 |
| FISKARS PLASTIC AXE |  | 1 | 1 |
| FURNITURE - INTERIORS - ARCHITECTURE |  | 3 | 4 |
| GAME - THE DOUBLE CROSSING |  | 1 | 4 |
| LIGHTING |  | 1 | 4 |
| MEDICAL - HEALTHCARE |  | 5 | 9 |
| MODULAR BANKSTICKS - PODS |  | 1 | 3 |
| NURSE CALL SYSTEMS |  | 1 | 1 |
| PRODUCTS |  | 7 | 13 |
| BEER PUMP |  | 1 | 2 |
| DOG FITNESS TRACKER |  | 1 | 1 |
| EFFIE - AUTOMATIC IRONING MACHINE |  | 1 | 1 |
| FURNITURE DESIGN |  | 2 | 2 |
| GARDENING TOOLS |  | 1 | 1 |
| MONITOR STAND |  | 1 | 1 |
| ROLLERBLADES |  | 1 | 1 |
| SKATEBOARD |  | 1 | 1 |
| SMART DIGITAL SHOWER |  | 1 | 2 |
| ROBOTIC ARM |  | 1 | 1 |
| TAUR - ELECTRICAL SCOOTER |  | 1 | 1 |
| TRAFFIC LIGHTS |  | 1 | 1 |
| WEARABLES - SMART GLASSES |  | 1 | 1 |
| WINE GLASS DISHWASHER ACCESSORY |  | 1 | 1 |
| THEIR TAKE ON AM | What they are trying to achieve by using AM - what is the real reason for their choice of using this technology, their driving motives - also their main direction in the use of AM | 13 | 54 |
| TRAINING - LEARNING | General category related to the way in which the interviewees have come to train in AM or in CAD or in digital skills in general. This might be eventually incorporated or merged with the EDUCATION category, even if for the moment this is directly referred to the learning and training of the designers interviewed, while the EDUCATION category refers to Institutional education in school for new designers or future students. | 7 | 16 |

Codes\\RQ CODES (Higher level - Deductive- Abstract)

Further level of abstraction obtained by deductively iinterrogating the data elicited in the GT CODES according to the main 5 Research Questions (RQ) of the project. This is a higher level of coding, ideally a further layer of clustering allowing the themes hidden in the capillary GT codes to emerge.

| Name | Description | Files | References |
| --- | --- | --- | --- |
| RQ1 - AM IMPACT ON PRODUCT DESIGN PRACTICE | Research Question 1 : Will Additive Manufacturing transform product design practice, processes, methods and tools and how? | 23 | 1424 |
| IMPACT IN ATTITUDES AND APPROACHES | enabled by new opportunities | 23 | 297 |
| EMBRACING IMPERFECTION IN DESIGN PROCESS | Used to be 'FAILURE' - changed in IMPERFECTION Coded at #IMPERFECTIONS- MISTAKES - CHANCE, #MIMICKING NATURE - NON 3D PRINT, #HUMAN TOUCH - UNIQUENESS | 9 | 26 |
| END TO END INVOLVEMENT INTO THE PROCESS | AM Designer becomes the Manufacturer or is involved in the entire workflow from beginning to end product --- Coded at #IN-HOUSE - OWN PRINTERS, #DESKTOP PRINTERS #END TO END INVOLVMENT | 15 | 28 |
| INDEPENDENCE - FREEDOM - VERSATILITY | Working independently - freedom in terms of creative process but also practical constraints - Coded at #INDEPENDENCE, #DIY,#IN-HOUSE, OWN PRINTER, #DESKTOP PRINTER #ECLECTICISM - VERSATILITY | 14 | 47 |
| REASONS FOR ADOPTING 3D PRINTING | How/Why they use 3D Printing - Coded at #THEIR TAKE ON AM - NOTE: this can be merged or is conceptually overlapping with the ' MOTIVATIONS' subtheme in RQ3 | 13 | 58 |
| UBIQUITY OF AM | The possibility to work anywhere and to send work anywhere just by exchanging files digitally that will be printed or evaluated by the customer remotely | 2 | 7 |
| Use of software in the design process | see also RQ1 - RQ4 and RQ5 - Not the typical CAD software - Using a multitude of tools - adventorous use of software | 23 | 131 |
| 2D Software |  | 4 | 7 |
| COREL DRAW |  | 1 | 1 |
| FIGMA |  | 1 | 1 |
| ILLUSTRATOR |  | 2 | 2 |
| PHOTOSHOP |  | 2 | 3 |
| 3D Printing |  | 8 | 11 |
| 3MATIC by MATERIALISE |  | 1 | 2 |
| 3MF |  | 1 | 2 |
| CURA |  | 3 | 3 |
| ULTIMAKER SLICER SOFTWARE |  | 1 | 1 |
| MAGICS |  | 1 | 1 |
| PRUSA |  | 2 | 2 |
| SLICING SOFTWARE (Unspecified) |  | 1 | 1 |
| Architecture |  | 1 | 3 |
| AUTOCAD |  | 1 | 1 |
| BEAM for RHINO (REVIT) |  | 1 | 1 |
| REVIT |  | 1 | 1 |
| CAD (generic) |  | 11 | 26 |
| Computational |  | 8 | 21 |
| GRASSHOPPER |  | 7 | 10 |
| HYPERGANIC |  | 1 | 1 |
| NTOPOLOGY |  | 3 | 4 |
| RHINO COMPUTE |  | 1 | 1 |
| TOPOLOGY OPTIMIZATION |  | 3 | 5 |
| Gaming and Movie Industry |  | 9 | 21 |
| 3D STUDIO MAX |  | 2 | 2 |
| BLENDER |  | 5 | 9 |
| GAMING DESIGN SOFTWARE |  | 1 | 2 |
| HOUDINI |  | 3 | 3 |
| MAYA |  | 1 | 2 |
| UNKNOWN MESHING ALGORHYTHM |  | 1 | 2 |
| ZBRUSH |  | 1 | 1 |
| Product Design |  | 14 | 36 |
| ALIAS STUDIO TOOLS |  | 1 | 1 |
| CREO |  | 1 | 1 |
| FUSION 360 |  | 3 | 3 |
| RHINO |  | 11 | 20 |
| SOLIDWORKS |  | 6 | 9 |
| TSPLINES |  | 1 | 2 |
| Rendering |  | 2 | 4 |
| KEYSHOT |  | 2 | 3 |
| VRAY |  | 1 | 1 |
| Simulation |  | 1 | 2 |
| MSC MARC |  | 1 | 1 |
| MSC SCFLOW |  | 1 | 1 |
| IMPACT IN DESIGN INTENT | In a way not previously possible. | 21 | 164 |
| COMPLEXITY AND DETAIL | See also RQ2 - With Digital design you can go much more in detail and design very complex structures that would take so much more time if manually designed). #COMPLEXITY/SIMPLICITY and #ARTICULATED PRINTS, CHAINS; LINKS | 9 | 27 |
| CUSTOMISATION | See RQ2 and RQ3 It allows to customise and personalise everything. - Coded from #CUSTOMISATION | 8 | 43 |
| VISUAL AND FUNCTIONAL COMBINATION | See RQ3 and RQ5 / The dichotomy of tech-based design and art-based design Coded at #ART vs TECHNOLOGY and #CONTRAST BETWEEN AESTHETICS AND FUNCTIONALITY and #FORM FROM TECHNOLOGY and #AESTHETICS - STYLE - VISUAL ASPECT # PERFORMANCE | 18 | 87 |
| WHAT CAN BE DONE ONLY WITH AM OR THROUGH CAD | exploration of design that can be achieved only by meand of 3d Printing and digital design Coded at #WHAT CAN BE ONLY DONE WITH AM OR THROUGH CAD | 5 | 7 |
| IMPACT IN DESIGN PROCESS, TOOLS AND METHODS | all changes related to the doing | 23 | 765 |
| ADVANTAGES - POSITIVES |  | 17 | 43 |
| CRAFTS AND DIGITAL MODELMAKING | See also RQ5 and RQ4 MODELMAKING PROTOTYPING AND ITERATION / handmade vs digitally made or virtually made models and mockups or even a combination of the two approaches - Coded at #DIGITAL MOCKUPS - SIMULATIONS, #DIGITAL STOCK, #FOR PROTOTYPING, MODELMAKING, MOCKUPS, #MODELMAKING, MOCKUPS #DESIGNING THROUGH MAKING # MANUALITY - HANDMAKING #CRAFTS #DIY #CRAFT INTEGRATION | 22 | 107 |
| DESIGN FOR AM | Designing with the technology in mind, for AM and around the features of AM / coded at #DESIGN FOR AM | 10 | 42 |
| FROM HAND DRAWING TO CAD | Coded at #CAD (generic), #SKETCHING DRAWING and in theory all the #SOFTWARE should be included so check also EXPLORATION OF SOFTWARE and CAD | 17 | 62 |
| MODELMAKING, PROTOTYPING AND ITERATION | See also RQ4 and RQ5 EVOLUTION IN PROTOTYPING / the two codes are almost oveapping / Coded at #ITERATIONS #DIGITAL MOCKUPS - SIMULATIONS, #EVALUATION, MODIFICATION and #SIMULATIONS - GENERATIVE DESIGN #SAMPLING - TESTING and #MODELMAKING, MOCKUPS #FOR PROTOTYPING and #PROTOTYPING | 23 | 176 |
| PARAMETRIC, DATA-BASED AND COMPUTATIONAL DESIGN | Coded from #PARAMETRIC MODELLING and #SIMULATIONS - GENERATIVE DESIGN & FEA and #DATA-BASED DESIGN | 12 | 60 |
| PROTOTYPING = MANUFACTURING | See also RQ2 / Your prototyping process is the same as your manufacturing process The designer is now the manufacturer. #FOR PRODUCTION #MADE TO ORDER - PRINT ON DEMAND #MASS PRODUCTION - LARGE QUANTITIES # SMALL PRODUCTION - NICHE | 17 | 68 |
| FOR PRODUCTION |  | 15 | 31 |
| MADE TO ORDER - PRINT ON DEMAND |  | 5 | 7 |
| MASS PRODUCTION - LARGE QUANTITIES |  | 8 | 11 |
| SMALL PRODUCTION - NICHE |  | 10 | 18 |
| SPEED, COST, EASE | See also RQ2 Coding at #ADVANTAGES - POSITIVES, #BUDGET-COST, #COST and #TIME CONSTRAINTS #SPEED #EFFICIENCY | 20 | 76 |
| USE OF SPECIFIC SOFTWARE | Not the typical CAD software - Using a multitude of tools - | 23 | 131 |
| 2D Software |  | 4 | 7 |
| COREL DRAW |  | 1 | 1 |
| FIGMA |  | 1 | 1 |
| ILLUSTRATOR |  | 2 | 2 |
| PHOTOSHOP |  | 2 | 3 |
| 3D Printing |  | 8 | 11 |
| 3MATIC by MATERIALISE |  | 1 | 2 |
| 3MF |  | 1 | 2 |
| CURA |  | 2 | 2 |
| MAGICS |  | 1 | 1 |
| PRUSA |  | 2 | 2 |
| SLICING SOFTWARE (Unspecified) |  | 1 | 1 |
| ULTIMAKER SLICER SOFTWARE |  | 1 | 1 |
| Architecture |  | 1 | 3 |
| AUTOCAD |  | 1 | 1 |
| BEAM for RHINO (REVIT) |  | 1 | 1 |
| REVIT |  | 1 | 1 |
| CAD (generic) |  | 11 | 26 |
| Computational |  | 8 | 21 |
| GRASSHOPPER |  | 7 | 10 |
| HYPERGANIC |  | 1 | 1 |
| NTOPOLOGY |  | 3 | 4 |
| RHINO COMPUTE |  | 1 | 1 |
| TOPOLOGY OPTIMIZATION |  | 3 | 5 |
| Gaming and Movie Industry |  | 9 | 21 |
| 3D STUDIO MAX |  | 2 | 2 |
| BLENDER |  | 5 | 9 |
| GAMING DESIGN SOFTWARE |  | 1 | 2 |
| HOUDINI |  | 3 | 3 |
| MAYA |  | 1 | 2 |
| UNKNOWN MESHING ALGORHYTHM |  | 1 | 2 |
| ZBRUSH |  | 1 | 1 |
| Product Design |  | 14 | 36 |
| ALIAS STUDIO TOOLS |  | 1 | 1 |
| CREO |  | 1 | 1 |
| FUSION 360 |  | 3 | 3 |
| RHINO |  | 11 | 20 |
| SOLIDWORKS |  | 6 | 9 |
| TSPLINES |  | 1 | 2 |
| Rendering |  | 2 | 4 |
| KEYSHOT |  | 2 | 3 |
| VRAY |  | 1 | 1 |
| Simulation |  | 1 | 2 |
| MSC MARC |  | 1 | 1 |
| MSC SCFLOW |  | 1 | 1 |
| IMPACT IN KNOWLEDGE | changes needed for interacting with this technology or brought in by the technology itself | 22 | 198 |
| CODING - PROGRAMMING - DIGITAL PROFICIENCY | coding knowledge or the ability to master various software and plugins for CAD and AM and select the appropriate tool for each design situation or the ability to personalise and customise algorithms for desiging and printing - Coded at #CODING | 2 | 4 |
| EXPLORATION | new forms of knowledge that a new technology like AM offers through exploratory work - Coded at #EXPLORATION | 9 | 59 |
| TECHNOLOGICAL KNOWLEDGE | See RQ4, RQ2 Materials knowledge - Engineering knowledge - Scientific knowledge - CAD knowledge since the printing technology and the design are working in unison and cannot be separated | 22 | 135 |
| KNOWLEDGE OF PRINTING TECHNOLOGY | the knowledge enabling to choose which printing technology is the most suitable but also the knowledge of how to implement correctly and effectvely the printing technology chosen. Coded at #KNOWLEDGE OF PRINTING TECHNOLOGY and #WHAT CAN BE PRINTED AND WHAT CANNOT | 10 | 25 |
| MANUFACTURABILITY - KNOWLEDGE OF | Can overlap with code KNOWLEDGE OF PRINTING TECHNOLOGY / it refers to what designs can be actually manufactured.Coded at #MANUFACTURING - MANUFACTURABILITY | 14 | 55 |
| MATERIALS - FINISHES - COLOURING (see also CHANGES IN DESIGN INTENT - INTEGRATION WITH MATERIALS) | Coded at #PRINTING FOR/WITH MATERIALS and #MATERIALS, FINISHES, COLOURING | 16 | 55 |
| RQ2 - OPPORTUNITIES AND CHALLENGES | What are the key opportunities and challenges for product design practice now and in the future? THIS can be analysed together with RQ3 because many of these challenges or opportunities are perceptions, speculations, opinions expressed by the designers, not objective facts. | 23 | 959 |
| CHALLENGES |  | 23 | 306 |
| ADAPTATION TO NEW TOOLS | First approaches, challenges or resistance to adapt or adopt the new tools and technologies or aspects related to them - Coded at #ADAPTATION - ADOPTION OF 3D PRINTING and #FIRST APPROACHES WITH AM | 11 | 23 |
| BUDGET, COSTING | coded at #COST and #BUDGET/ COSTING | 17 | 61 |
| DISADVANTAGES, NEGATIVES | coded at #DISADVANTAGES OF NEW TECHNOLOGIES #DISADVANTAGES, NEGATIVES and #CONCERNS ABOUT AM | 9 | 36 |
| LICENSING - COPYRIGHT - CERTIFICATIONS - STANDARDS |  | 7 | 23 |
| SCALE - PROPORTION - PRECISION | coded at # SCALE / TOLERANCES ,#]SCALE/MEASURES/TOLERANCES | 13 | 28 |
| TECHNOLOGICAL KNOWLEDGE | See RQ4, RQ2 Materials knowledge - Engineering knowledge - Scientific knowledge - CAD knowledge since the printing technology and the design are working in unison and cannot be separated | 22 | 135 |
| KNOWLEDGE OF PRINTING TECHNOLOGY | the knowledge enabling to choose which printing technology is the most suitable but also the knowledge of how to implement correctly and effectvely the printing technology chosen. Coded at #KNOWLEDGE OF PRINTING TECHNOLOGY and #WHAT CAN BE PRINTED AND WHAT CANNOT | 10 | 25 |
| MANUFACTURABILITY - KNOWLEDGE OF | Can overlap with code KNOWLEDGE OF PRINTING TECHNOLOGY / it refers to what designs can be actually manufactured.Coded at #MANUFACTURING - MANUFACTURABILITY | 14 | 55 |
| MATERIALS - FINISHES - COLOURING (see also CHANGES IN DESIGN INTENT - INTEGRATION WITH MATERIALS) | Coded at #PRINTING FOR/WITH MATERIALS and #MATERIALS, FINISHES, COLOURING | 16 | 55 |
| DEBATABLE |  | 22 | 213 |
| DEMOCRATISATION OF DESIGN |  | 7 | 22 |
| IMPACT OF AI - VR | Coded at #AI and #VR | 14 | 53 |
| RELATIONSHIP WITH CLIENTS | If clients are unable to understand the digital or visual language, even worse when the designer is only coding ory programming, there might be issues, especially for commissioning or getting feedback etc coded at #RELATIONSHIP WITH CUSTOMERS | 13 | 61 |
| SUSTAINABILITY - RESOURCE MANAGEMENT | Coded at # SUSTAINABILITY/ ENVIRONMENTAL IMPACT #SOCIAL IMPACT ETHICS | 17 | 77 |
| OPPORTUNITIES |  | 23 | 440 |
| COMPLEXITY AND DETAIL | See also RQ1 - With Digital design you can go much more in detail and design very complex structures that would take so much more time if manually designed). #COMPLEXITY/SIMPLICITY and #ARTICULATED PRINTS, CHAINS; LINKS | 9 | 27 |
| CREATIVITY - INNOVATION - PUSHING THE BOUNDARIES - PIONEERING - ACHIEVEMENT - RESEARCH | Coded at #CREATIVITY- MAKE IT DIFFERENT - NEED FOR NOVELTY, #INNOVATION #PUSHING AM FORWARD # PUSHING THE BOUNDARIES OF DESIGN # WHAT CAN BE ONLY DONE WITH AM OR THROUGH CAD # BEING AT THE CUTTING-EDGE #BREAKING THE RULES - GOING AGAINST THE TIDE # INNOVATION | 20 | 172 |
| CUSTOMISATION - PERSONALISATION | See RQ1 and RQ3 | 8 | 43 |
| INDEPENDENCE - FREEDOM - VERSATILITY | Working independently - freedom in terms of creative process but also practical constraints - Coded at #INDEPENDENCE, #DIY,#IN-HOUSE, OWN PRINTER, #DESKTOP PRINTER #ECLECTICISM - VERSATILITY | 14 | 47 |
| PROTOTYPING = MANUFACTURING | See also RQ1 / Your prototyping process is the same as your manufacturing process The designer is now the manufacturer. #FOR PRODUCTION #MADE TO ORDER - PRINT ON DEMAND #MASS PRODUCTION - LARGE QUANTITIES # SMALL PRODUCTION - NICHE | 17 | 68 |
| FOR PRODUCTION |  | 15 | 31 |
| MADE TO ORDER - PRINT ON DEMAND |  | 5 | 7 |
| MASS PRODUCTION - LARGE QUANTITIES |  | 8 | 11 |
| SMALL PRODUCTION - NICHE |  | 10 | 18 |
| SPEED, COST, EASE | See also RQ1 Coding at #ADVANTAGES - POSITIVES, #BUDGET-COST, #COST and #TIME CONSTRAINTS #SPEED #EFFICIENCY | 20 | 76 |
| UBIQUITY OF AM |  | 2 | 7 |
| RQ3 - DESIGNERS' PERCEPTIONS AND ADAPTATIONS | What do Designers know, think and feel about Additive Manufacturing, broader technological change and the likely evolution of product design practice? | 23 | 1391 |
| BARRIERS | Difficulties encountered or perceived - Dilemmas - Resistances - Perceived negatives or Fears | 20 | 139 |
| ADAPTATION TO NEW TOOLS | First approaches, challenges or resistance to adapt or adopt the new tools and technologies or aspects related to them - Coded at #ADAPTATION - ADOPTION OF 3D PRINTING and #FIRST APPROACHES WITH AM | 11 | 23 |
| AESTHETICS vs FUNCTIONALITY | See RQ1 and RQ5 coded at #FUNCTIONALITY,#ART vs FUNCTIONALITY,#AESTHETICS - STYLE - VISUAL ASPECTS, #ART vs TECHNOLOGY, #CONTRAST BETWEEN AESTHETICS vs FUNCTIONALITY, #PERFORMANCE, #PERFORMANCE - PHYSICS CONTSTRAINTS | 18 | 87 |
| COPYRIGHT - LICENSING - CERTIFICATIONS - STANDARDS |  | 7 | 23 |
| STANDARDISATION - CREATIVE LIMITATIONS | This is referred to the progressive development of machines and software that tend to become more 'user-friendly' but simplified, standardised, allowing less space and freedom for personalising the interaction with the machine/software itself. | 2 | 6 |
| COLLABORATION + PEOPLE | Perceptions about teamwork - communities - knowledge exchange - collaborative work | 23 | 253 |
| CO-CREATION |  | 6 | 17 |
| COMMUNITY - COLLABORATION - SHARING |  | 7 | 46 |
| LIAISING WITH THE MANUFACTURERS or EXTERNAL EXPERTS |  | 12 | 40 |
| RELATIONSHIP WITH CLIENTS | referred to all the comments where the interviewee mentions the Client as a variable upon which certain aspects of the design process might depend. | 13 | 61 |
| TEAM WORK - SPECIALISED ROLES |  | 12 | 38 |
| USERS EXPERIENCE - CUSTOMER FACING - HUMAN CENTRIC DESIGN |  | 13 | 50 |
| LEARNING |  | 18 | 175 |
| ENGINEERING - SCIENTIFIC KNOWLEDGE | See RQ4 and RQ5 Coded at #GEOMETRY - TRIGONOMETRY - ERGONOMICS - MATHEMATICS - CALCULUS, #SCIENCE - RESEARCH-BASED | 10 | 30 |
| EXPLORATION AND EXPERIMENTATION | coded at #EXPLORATION | 9 | 59 |
| FIRST APPROACHES WITH AM | Coded at # ADAPTATION - ADOPTION OF 3D PRINTING and #FIRST APPROACHES WITH AM | 10 | 33 |
| PROBLEM SOLVING SKILLS - CRITICAL THINKING | Coded at #PROBLEM SOLVING - #CRITICAL THINKING | 8 | 29 |
| SIMULATIONS - GENERATIVE DESIGN - FEA |  | 5 | 10 |
| TRAINING - LEARNING - SELF-TAUGHT - ONLINE EXCHANGE | Where the knowledge about AM and CAD design has come from | 9 | 14 |
| MOTIVATIONS |  | 23 | 429 |
| CREATIVITY - INNOVATION - PUSHING THE BOUNDARIES - PIONEERING - ACHIEVEMENT - RESEARCH | Coded at #CREATIVITY- MAKE IT DIFFERENT - NEED FOR NOVELTY, #INNOVATION #PUSHING AM FORWARD # PUSHING THE BOUNDARIES OF DESIGN # WHAT CAN BE ONLY DONE WITH AM OR THROUGH CAD # BEING AT THE CUTTING-EDGE #BREAKING THE RULES - GOING AGAINST THE TIDE # INNOVATION | 20 | 170 |
| ENTHUSIASM - PASSION - CURIOSITY - EGO - VANITY |  | 4 | 10 |
| ETHICS - SUSTAINABILITY | Coded at #SUSTAINABILITY - ENVIRONMENTAL ASPECTS, #MATERIAL WASTE- RECYCLING | 17 | 77 |
| INDEPENDENCE - FREEDOM - VERSATILITY | Working independently - freedom in terms of creative process but also practical constraints - Coded at #INDEPENDENCE, #DIY,#IN-HOUSE, OWN PRINTER, #DESKTOP PRINTER #ECLECTICISM - VERSATILITY | 14 | 47 |
| NOT JUST FOR PROTOTYPING |  | 22 | 125 |
| FOR MOLDMAKING |  | 1 | 4 |
| FOR PRODUCING THE PRODUCTION PARTS |  | 1 | 2 |
| FOR PRODUCT VALIDATION |  | 1 | 4 |
| FOR PRODUCTION |  | 15 | 53 |
| FOR PROTOTYPING - MODELMAKING - MOCKUPS |  | 17 | 61 |
| PERSPECTIVES | Designers' apprehension of the direction of their AM practice or the impact of AM on Product Design | 23 | 395 |
| BUDGET - COSTING | coded at #COST and #BUDGET/ COSTING | 17 | 61 |
| CUSTOMISATION | See RQ1 and RQ2 | 8 | 43 |
| DEMOCRATISATION OF DESIGN |  | 7 | 22 |
| DESIGNERS' EXPERTISE | The counterpart of Democratisation of Design - Skills, experiences and intuitions that are the Designer's tookbox - Coded at #DESIGNER EXPERIENCE, #DESIGNER'S INTUITION, #DESIGNERS SKILLS | 12 | 55 |
| FUTURE | This code groups all comments made to the question abour where AM is headed or where their AM practice is headed, so it is about their perception about future developments - Sometimes can be overlap with discourses about VR or AI and these are codes contained in DESIGN ASPECTS - possibility to copy them here too or to merge later, if necessary - Coded at #FUTURE & FORESIGHT and #FUTURE | 13 | 33 |
| IMPACT OF VR - AI |  | 14 | 53 |
| PARAMETRIC, DATA-BASED AND COMPUTATIONAL DESIGN | Coded from #PARAMETRIC MODELLING and #SIMULATIONS - GENERATIVE DESIGN & FEA and #DATA-BASED DESIGN | 12 | 60 |
| PROTOTYPING = MANUFACTURING | See also RQ1 / Your prototyping process is the same as your manufacturing process The designer is now the manufacturer. #FOR PRODUCTION #MADE TO ORDER - PRINT ON DEMAND #MASS PRODUCTION - LARGE QUANTITIES # SMALL PRODUCTION - NICHE | 17 | 68 |
| FOR PRODUCTION |  | 15 | 31 |
| MADE TO ORDER - PRINT ON DEMAND |  | 5 | 7 |
| MASS PRODUCTION - LARGE QUANTITIES |  | 8 | 11 |
| SMALL PRODUCTION - NICHE |  | 10 | 18 |
| RQ4 - IMPACT ON JOBS AND SKILLS | How will Additive Manufacturing change product design jobs and skill requirements? | 23 | 523 |
| JOBS |  | 15 | 89 |
| COMPUTATIONAL DESIGNER FIGURE |  | 12 | 60 |
| CONSULTANT ROLES | CODED AT #AM CONSULTANT and #NEW JOBS AND SKILLS | 4 | 8 |
| REMOTE WORK - GLOBAL REACH - UBIQUITOUS DESIGN PROCESS |  | 2 | 8 |
| TEAMWORK - COLLABORATION - ONLINE PRESENCE - COMMUNITY |  | 7 | 11 |
| SKILLS |  | 23 | 433 |
| CODING - PROGRAMMING - DIGITAL PROFICIENCY | coding knowledge or the ability to master various software and plugins for CAD and AM and select the appropriate tool for each design situation or the ability to personalise and customise algorithms for desiging and printing - Coded at #CODING | 2 | 4 |
| ENGINEERING - SCIENTIFIC KNOWLEDGE |  | 10 | 30 |
| INTEGRATION OF MANUAL AND DIGITAL | See also RQ1 Crafts and digital modelmaking | 22 | 107 |
| TECHNOLOGICAL KNOWLEDGE | See RQ4, RQ2 Materials knowledge - Engineering knowledge - Scientific knowledge - CAD knowledge since the printing technology and the design are working in unison and cannot be separated | 22 | 135 |
| KNOWLEDGE OF PRINTING TECHNOLOGY | the knowledge enabling to choose which printing technology is the most suitable but also the knowledge of how to implement correctly and effectvely the printing technology chosen. Coded at #KNOWLEDGE OF PRINTING TECHNOLOGY and #WHAT CAN BE PRINTED AND WHAT CANNOT | 10 | 25 |
| MANUFACTURABILITY - KNOWLEDGE OF | Can overlap with code KNOWLEDGE OF PRINTING TECHNOLOGY / it refers to what designs can be actually manufactured.Coded at #MANUFACTURING - MANUFACTURABILITY | 14 | 55 |
| MATERIALS - FINISHES - COLOURING (see also CHANGES IN DESIGN INTENT - INTEGRATION WITH MATERIALS) | Coded at #PRINTING FOR/WITH MATERIALS and #MATERIALS, FINISHES, COLOURING | 16 | 55 |
| USE OF SPECIFIC SOFTWARE | Not the typical CAD software - Using a multitude of tools - | 23 | 131 |
| 2D Software |  | 4 | 7 |
| COREL DRAW |  | 1 | 1 |
| FIGMA |  | 1 | 1 |
| ILLUSTRATOR |  | 2 | 2 |
| PHOTOSHOP |  | 2 | 3 |
| 3D Printing |  | 8 | 11 |
| 3MATIC by MATERIALISE |  | 1 | 2 |
| 3MF |  | 1 | 2 |
| CURA |  | 2 | 2 |
| MAGICS |  | 1 | 1 |
| PRUSA |  | 2 | 2 |
| SLICING SOFTWARE (Unspecified) |  | 1 | 1 |
| ULTIMAKER SLICER SOFTWARE |  | 1 | 1 |
| Architecture |  | 1 | 3 |
| AUTOCAD |  | 1 | 1 |
| BEAM for RHINO (REVIT) |  | 1 | 1 |
| REVIT |  | 1 | 1 |
| CAD (generic) |  | 11 | 26 |
| Computational |  | 8 | 21 |
| GRASSHOPPER |  | 7 | 10 |
| HYPERGANIC |  | 1 | 1 |
| NTOPOLOGY |  | 3 | 4 |
| RHINO COMPUTE |  | 1 | 1 |
| TOPOLOGY OPTIMIZATION |  | 3 | 5 |
| Gaming and Movie Industry |  | 9 | 21 |
| 3D STUDIO MAX |  | 2 | 2 |
| BLENDER |  | 5 | 9 |
| GAMING DESIGN SOFTWARE |  | 1 | 2 |
| HOUDINI |  | 3 | 3 |
| MAYA |  | 1 | 2 |
| UNKNOWN MESHING ALGORHYTHM |  | 1 | 2 |
| ZBRUSH |  | 1 | 1 |
| Product Design |  | 14 | 36 |
| ALIAS STUDIO TOOLS |  | 1 | 1 |
| CREO |  | 1 | 1 |
| FUSION 360 |  | 3 | 3 |
| RHINO |  | 11 | 20 |
| SOLIDWORKS |  | 6 | 9 |
| TSPLINES |  | 1 | 2 |
| Rendering |  | 2 | 4 |
| KEYSHOT |  | 2 | 3 |
| VRAY |  | 1 | 1 |
| Simulation |  | 1 | 2 |
| MSC MARC |  | 1 | 1 |
| MSC SCFLOW |  | 1 | 1 |
| VISUALISATION - VR - RENDERING |  | 11 | 26 |
| RQ5 - IMPLICATIONS FOR EDUCATION AND TRAINING | What will the implications for design education and traning be? | 23 | 629 |
| ADVANCED TRAINING IN SOFTWARE | See also RQ1 and RQ4 | 23 | 138 |
| CODING - PROGRAMMING SKILLS | coded at #CODING | 2 | 4 |
| USE OF SPECIFIC SOFTWARE | Not the typical CAD software - Using a multitude of tools - | 23 | 131 |
| 2D Software |  | 4 | 7 |
| COREL DRAW |  | 1 | 1 |
| FIGMA |  | 1 | 1 |
| ILLUSTRATOR |  | 2 | 2 |
| PHOTOSHOP |  | 2 | 3 |
| 3D Printing |  | 8 | 11 |
| 3MATIC by MATERIALISE |  | 1 | 2 |
| 3MF |  | 1 | 2 |
| CURA |  | 2 | 2 |
| MAGICS |  | 1 | 1 |
| PRUSA |  | 2 | 2 |
| SLICING SOFTWARE (Unspecified) |  | 1 | 1 |
| ULTIMAKER SLICER SOFTWARE |  | 1 | 1 |
| Architecture |  | 1 | 3 |
| AUTOCAD |  | 1 | 1 |
| BEAM for RHINO (REVIT) |  | 1 | 1 |
| REVIT |  | 1 | 1 |
| CAD (generic) |  | 11 | 26 |
| Computational |  | 8 | 21 |
| GRASSHOPPER |  | 7 | 10 |
| HYPERGANIC |  | 1 | 1 |
| NTOPOLOGY |  | 3 | 4 |
| RHINO COMPUTE |  | 1 | 1 |
| TOPOLOGY OPTIMIZATION |  | 3 | 5 |
| Gaming and Movie Industry |  | 9 | 21 |
| 3D STUDIO MAX |  | 2 | 2 |
| BLENDER |  | 5 | 9 |
| GAMING DESIGN SOFTWARE |  | 1 | 2 |
| HOUDINI |  | 3 | 3 |
| MAYA |  | 1 | 2 |
| UNKNOWN MESHING ALGORHYTHM |  | 1 | 2 |
| ZBRUSH |  | 1 | 1 |
| Product Design |  | 14 | 36 |
| ALIAS STUDIO TOOLS |  | 1 | 1 |
| CREO |  | 1 | 1 |
| FUSION 360 |  | 3 | 3 |
| RHINO |  | 11 | 20 |
| SOLIDWORKS |  | 6 | 9 |
| TSPLINES |  | 1 | 2 |
| Rendering |  | 2 | 4 |
| KEYSHOT |  | 2 | 3 |
| VRAY |  | 1 | 1 |
| Simulation |  | 1 | 2 |
| MSC MARC |  | 1 | 1 |
| MSC SCFLOW |  | 1 | 1 |
| BALANCE BETWEEN TRADITIONAL AND MODERN (DIGITAL) METHODS | See also RQ1 and RQ4 | 22 | 106 |
| CRITICAL THINKING - INTUITION - PROBLEM SOLVING | Coded at #CRITICAL THINKING, #DESIGN THINKING, # DESIGNER'S INTUITION, #PROBLEM SOLVING | 14 | 33 |
| DIGITAL AESTHETICS | See RQ1 and RQ3 | 18 | 87 |
| EDUCATION | General Category referred to Institutional Education, possible avenues for future training of students, courses, etc. | 16 | 47 |
| EDUCATING THE PUBLIC |  | 1 | 2 |
| INTERNSHIPS & LEARNING BY PRACTICING | Coded at #TRAINING, LEARNING | 7 | 16 |
| STUDENTS SKILLS |  | 9 | 16 |
| ENGINEERING - MATHS - GEOMETRY - SCIENTIFIC KNOWLEDGE |  | 10 | 29 |
| SCALES - PROPORTIONS - MODELMAKING |  | 1 | 1 |
| TECHNOLOGICAL KNOWLEDGE | See RQ4, RQ2 Materials knowledge - Engineering knowledge - Scientific knowledge - CAD knowledge since the printing technology and the design are working in unison and cannot be separated | 22 | 135 |
| KNOWLEDGE OF PRINTING TECHNOLOGY | the knowledge enabling to choose which printing technology is the most suitable but also the knowledge of how to implement correctly and effectvely the printing technology chosen. Coded at #KNOWLEDGE OF PRINTING TECHNOLOGY and #WHAT CAN BE PRINTED AND WHAT CANNOT | 10 | 25 |
| MANUFACTURABILITY - KNOWLEDGE OF | Can overlap with code KNOWLEDGE OF PRINTING TECHNOLOGY / it refers to what designs can be actually manufactured.Coded at #MANUFACTURING - MANUFACTURABILITY | 14 | 55 |
| MATERIALS - FINISHES - COLOURING (see also CHANGES IN DESIGN INTENT - INTEGRATION WITH MATERIALS) | Coded at #PRINTING FOR/WITH MATERIALS and #MATERIALS, FINISHES, COLOURING | 16 | 55 |
| VIRTUAL AND AUGMENTED REALITY - AI | coded at #AI #VR | 14 | 53 |