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Resolving Issues in Documenting Visual Sign Language: Way Forward in the Era of Digital Communication

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Abstract:
Visual sign language has been in existence for quite some time as the world's most used third language. It comes in different flavours which can be likened to a dialect. Nigeria as a country has three different types with ASL (American Sign Language) as the most used in school education for the deaf. Issues in documenting the sign languages include determining what to document, reason for documentation and precisely who to document. During the critical investigation, studies proved that digital communication rooted in Artificial Intelligence (AI) can be adopted as an innovative solution to the issues. This is primarily a qualitative study, library research method was employed relying on secondary data. Conclusively, documenting visual sign languages will preserve and promote the various sign dialects among the hearing-impaired and also non-signers willing to learn. Suggestively, Artificial Intelligence should be ethically harnessed in communication and designs for documentation, education and social interactions. Therefore, Communication design experts, Prompt Engineers, Media and Information Technologists with the deaf educators should team up for a robust sign language data bank while relying on AI. All these are key, not only for documentation, but will also aid in the official recognition of the Nigerian visual sign language.

Keywords: Visual, Artificial Intelligence, Digital communication, Media, Sign language, Deaf.

حل المشكلات في توثيق لغة الإشارة البصرية: الطريق إلى الأمام في عصر الاتصال الرقمي

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الملخص:

لطالما وُجدت لغة الإشارة البصرية باعتبارها ثالث أكثر اللغات استخدامًا في العالم. وهي تأتي بأنماط مختلفة يمكن تشبيهها باللهجات. في نيجيريا، هناك ثلاثة أنواع مختلفة من لغات الإشارة، وتعد لغة الإشارة الأمريكية (ASL) الأكثر استخدامًا في تعليم الصم في المدارس. تتضمن التحديات في توثيق لغات الإشارة تحديد ما يجب توثيقه، والغرض من التوثيق، ومن المستهدف بالتوثيق تحديدًا. خلال التحقيق النقدي، أثبتت الدراسات أن الاتصال الرقمي القائم على الذكاء الاصطناعي يمكن أن يكون حلاً مبتكرًا لهذه المشكلات. تعد هذه الدراسة نوعية في المقام الأول، حيث تم اعتماد منهج البحث المكتبي بالاعتماد على البيانات الثانوية.

ختامًا، فإن توثيق لغات الإشارة البصرية سيساهم في حفظ وتعزيز مختلف لهجات الإشارة بين الأفراد ذوي الإعاقة السمعية وكذلك غير الناطقين بلغة الإشارة الراغبين في التعلم. ومن المقترح أن يتم توظيف الذكاء الاصطناعي بشكل أخلاقي في تصميمات الاتصال والتوثيق والتعليم والتفاعل الاجتماعي. لذا، ينبغي لخبراء تصميم الاتصال، ومهندسي البرمجيات المتخصصين في الذكاء الاصطناعي، وخبراء الإعلام وتقنيات المعلومات التعاون مع معلمي الصم لإنشاء قاعدة بيانات شاملة للغة الإشارة، بالاعتماد على الذكاء الاصطناعي. كل هذه الجهود ليست ضرورية فقط لأغراض التوثيق، بل ستساعد أيضًا في الاعتراف الرسمي بلغة الإشارة البصرية النيجيرية.

الكلمات المفتاحية :البصرية، الذكاء الاصطناعي، الاتصال الرقمي، الإعلام، لغة الإشارة، الصم

1. Introduction

Communication is notably impactful when it appeals to the human senses and especially when the content being presented is also substantial. This is the main goal of communication that can take the form of a visual message. The components of visual communication is not only audio-visual, signing is acceptably relevant. It is a language associated with the hearing impaired or the deaf. It is simplified as communication via hand movements i.e. visible hand gestures. In some cases, the gestures can even incorporate facial expressions to solidify meaning; thereby enriching the visual form of communication. Lip-reading is part of the gestures that can complement visual sign language (Baynton, 1996). What characterised hearing impaired is the inability to hear a complete

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sound or hear faintly thus resolves to use visual sign language. Technically, deafness can be categorised into congenital and sensorineural hearing loss or mild, moderate and severe hearing loss. In rating with decibels (dB), it means 20-40 dB is mild hearing loss, 41-60 dB is moderate, 61-80 dB is severe while profound hearing loss is above 81 dB; thus a complete deaf. The ear takes in sound waves then convert them into signals which are perceived as sound (normal at 60 dB) by the brain for interpretation (IQWiG, 2020). Ordinarily, humans are structured to consume sounds at that rate which is normal and not harmful to the ear. It is opined that any sound beyond 90 dB, with regard to human ear and health is considered to be dangerous, it can lead to serious hearing damage. If the ear is exposed to such sound frequently, hearing will turn to discomfort and pain. Historically, studies have recorded that visual sign language and education have been in existence since the mid-50s through the efforts of Rev. (Dr.) Andrew Foster, a missionary and also an African-American. He was a deaf graduate of Gallaudet University in the late 1950's (Anaekwe, 2023; S-Deli, 2018; Asonye & Edward, 2022).

Visuals in language and communication are of high importance while their essence even transcend information dissemination. They can mar or make the information, it is therefore meant to be used not only creatively but with some set standards considered. 'Visual language' is understood by different people within diverse contexts; while it is perceived as purely language in visuals by some, others understand it as a language in which it is the content that is visual. The former simply regard it as a language for processing visual information while the latter see it as a language for programming with visual expressions (Chang, 1986). Visual language can also be described from the angle of information science, which is to clarify and simplify raw data via visual representation. It is a process of communicating about data often tagged visualisation (Afolabi, 2023). It is obvious that in breaking down visual language, *"while there are certainly commonalities among these definitions, they differ in their scope. ...perceptions can change over time, as can the relevance of specific viewpoints"* (Erwig, Smeltzera, Wanga, 2016, pp.4 -5).

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Language as it is, is not the communication per say rather a dialect understood and accepted by a particular society, tribe or region. Bravolol (2023) maintained that it comes with differences in vocabulary, grammar, and pronunciation, thus language can be modified. On the other hand, communication whether digital or non-digital involves a process while visuals fall in between the two; to play key roles. In many cases, the function is not limited to creating meaning, its relevance (i.e. visuals) in documentation is also remarkable. Visual sign language is globally recognised and accepted; especially among the deaf. From observation, many countries have their own type(s) of visual signs, Nigeria inclusive but the Nigerian Sign Language (NSL) is not officially recognised. This was part of the lamentation of Michael (2023), Asonye and Edward (2022). Hlophe (2023) of Reuters also hinted that only 41 countries in the whole world recognised visual sign language as official; out of the 41 includes solely four African countries, excluding Nigeria. Pyers (2012) also agreed that only few sign languages have been fully documented. It is on this premise that stakeholders in the deaf community task the Federal Government to endorse the Nigerian Sign Language (NSL) as the second official language in Nigeria. It is believed that its documentation will go a long way to position the hearing impaired in a safe place where their voices would be heard (Michael, 2023). Additionally, without proper documentation, signers and even non-signers interested in the language cannot be fluent (Asonye and Edward, 2022) which is dicey for the visual language. This is a clear reason the documentation is essential, importantly as the visual sign languages are also used for education and communication, but how will this be achieved amidst identified issues? Unfortunately, while the issues seem subtle, they remained not to be trivialised. This is a major concern seeking solution, hence this study; which main aim is to find a way forward towards documenting the visual sign language in Nigeria. The scope of the study involves exploration of digital communication from the lens of Artificial Intelligence as a factor or tool for possible solution.

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2. Visual Sign Language: Variants and Issues

Dactylology i.e. visual (sign) language is the third most used language in the human world with example like the ASL which stands for American Sign Language (Ink & Salt LLC., 2023). Many countries: Nigeria, Ghana, Mexico, Commonwealth of the Dominica, Canada etc. have signers in abundance and they communicate on daily basis using one form of sign or another; for their engagements. For clarity, Canada developed her Langue des Signes Quebecoise (LSQ), also known as Quebec Sign Language. It is prominent in the French speaking territory and ASL has been endorsed by the Anglophone communities (Manitoba, n.d). Both are duly documented and officially recognised in Canada. Locally, Nigeria also have her own sign languages, as witnessed in the different versions applicable to Yoruba, the Hausas and Igbos. It has also been established that some minority tribes within Nigeria also have their own unique sign language. It is glaring that there is no universally accepted sign language as British Sign Language is different from American Sign Language (ASL); Nigeria Sign Language from that of Ghana. Interestingly, National Institute on Deafness and Other Communication Disorder maintained that *"many countries adopt features of ASL in their sign language"* (NIDCD, 2021), little wonder ASL is popular as a language among the signers (see Fig. 1).

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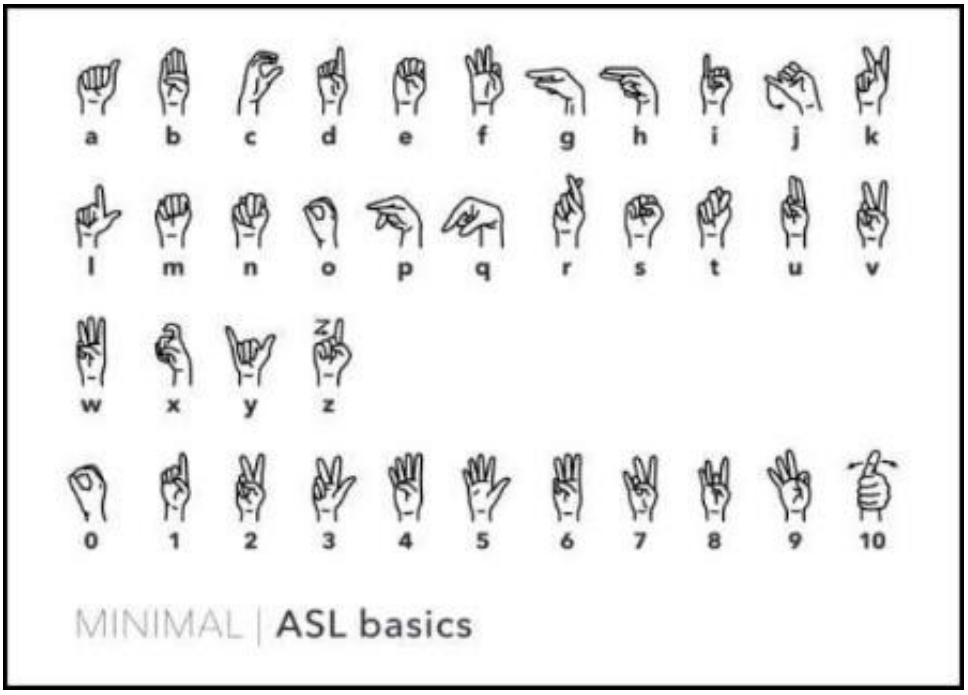

Fig. 1: American Sign Language; Source: Goehlert, A. (2023) – *https://istockphoto.com*

The fact that an African-American pioneered sign language as a means of communication and education in Nigeria, influenced the visual sign used. The missionary priest (Andrew Foster) practised the used of both American and indigenous signs during his lifetime. Thus, features of ASL are also evident in Nigeria Sign Language. However, Asonye and Edward (2022) argued that Nigeria sign language has developed over time; therefore achieved a different and unique status that differentiates it from ASL. The duo identified 'Magajin Gari Sign Language', 'Bura Sign Language' and 'Magana Hannu' as part of the (visual) sign languages used in Nigeria. They are based and used fluently for communication in the northern part of Nigeria while there is also the Akure Sign Language in the Southwest (Orie, 2013). Deaf signers can be either bilingual (signing in English word mixed with indigenous Sign Language) or monolingual (signing only in English word as learnt in schools or solely with the use of indigenous Sign Language) (Asonye & Edward, 2022).

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Whatever the case may be, it is still largely believed that ASL has influenced on many sign languages, irrespective of the variants. ASL, by virtue of characteristics, is regarded by Manitoba (n.d) as a full visual-gestural language; possessing its unique grammar, syntax and vocabulary. The body, hand and facial expressions such as mouth movement are engaged in the tactile and sign communication. The eyes are needed to perceive meaning, the hand, face etc. are engaged to express the meaning; as a result, face-to-face interaction is key in ASL communication (Manitoba, n.d).

From the foregoing, it can be deduced that since each visual sign language has its uniqueness, it is possible that a Yoruba signer may not understand the syntax and vocabularies involved in the Hausa and Igbo sign language. Simultaneously, *"sign languages occur in a variety of sociocultural contexts, ranging from sign languages used in the closed communities to officially recognised national sign languages"* (Pyers, 2012). This variants thus, eventually accentuate the essence of quality documentation. However, clear issues identified by Asonye and Edward (2022) is what to even document amidst the many indigenous languages, the reason(s) for the documentation and who is to be documented? The Scholar, Asonye, through Save the Deaf and Endangered Language Initiative pointed out that the importance of documentation is to preserve the language especially the indigenous Nigerian sign language which is also specifically ought to be documented. In the same vein, a deaf signer whose sign practises are not that of a formal education is expected to be documented; with the aid of a video technology (Asonye, Bamidele, Ini, Aribeana, Paul, and Onyediziri, 2018).

The preference is another bone of contention, in which one will tend to wonder if it is only such individuals that do it better. Humans are complex being, sensible, emotional, can reason and interact yet not perfect. Hence, innovatively, there should be another means to achieving same result of indigenous Nigerian sign language documentation, especially for perfection or a result close to perfection. This will complement what had been done, however, this is where technology

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excel, preferably digital communication anchored on Artificial Intelligence (AI).

3. Digital Communication and Possibilities through Artificial Intelligence

Communication is the exchange of information between people, e.g. by means of speaking, writing, or using a common system of signs or behaviour (Bravolol, 2023). It can also be described as a means of access to information. In the era of advanced technology, communication is exchanged in the digital mode. This discovery has made communication to be seamless; it goes farther beyond many borders. Communication in practise, that was before a 'one-to-many' exercise is currently 'many-to-many' engagement, all at a time. This is the effect of digital communication which is fluid. At the present, rigidity in traditional form of communication is softened. It is a system of communication with enriched opportunities which cut across virtually all areas of human endeavours. The introduction of computers and multimedia technologies are notable areas that premiered communication in the digital form. Internet of Things (IoT) is also worthy of mentioning in the 21st century. It is a networking of communication systems to aid smooth transmission of information and its exchange. This is exemplified in smart technologies: wearables, mobile devices, augmented and virtual reality among others. The change that has occurred over time due to the evolution of digital communication is conspicuous. TVs are getting more compact and curvy to accommodate the intricacies of communication in the digital form. Journalism is currently practised as a form of new media since internet is readily available. In addition, social media is another digital innovation and has its place to enrich information dissemination and retain audience of the media tagged: 'fans'. Digital communication has taken many different forms that it has spread its tentacles to all areas of information exchange one could think of. Apart from that, it is a system that is innovatively and creatively mutating, obviously through human efforts and quest for development. People, including the hearing impaired, want to communicate better, exchange ideas and information in

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a more simplified way. They rather want to learn in a flexible and more engaging manner. The fans of the media or consumers of the media products desired enriched flexibility across media platforms. A workflow process that is free from avoidable technical delays that gives room for creativity and interactivity is desired. As a result, all these summed up, gave birth to the recent trend, - the Artificial Intelligence (AI).

By virtue of exploration, AI is not directly a communication process but technically weaved into the process; thus, serves as a platform for robust digital communication. It supports interactivity, fluidity in the communication process and in practise; offers as well, clean and perfect result. Exemplarily, it manifest through prompts, text in chatbots, voice recognition, image mapping and processing capabilities, video editing and refinement, to mention but few. In the real advanced area, AI involves robotics that can also engage in communication. Artificial Intelligence (AI) is *"simply the use and integration of visual design, computer science, and robust information data to solve human problems"* (Afolabi, Odewole, Adeloye & Oyinloye, 2023 p.15). Information and visuals are core in communication; it is therefore apt to agree that AI is the 'live wire' of digital communication. An invention that is transformational such that it also permits personalised experience. It enhances the reach, engagement and accessibility in different ways. AI is a tool in the hand of a communicator: Journalist, Communication Designer, Photographer and Nonlinear Editor etc., especially as they are all involved in one form of information activity or another. The incorporation of AI into communication is broad, involving: Machine Learning (ML), Natural Language Processing (NLP), automation, augmented and virtual reality i.e. immersive communication, security/ network optimisation etc. The advantage of the wideness breeds robust efficiency in communication in-flow cum user experience, quality multimedia communication and convergent technologies. Global connectivity communications involving AI will make people (the deaf and non-deaf) to experience direct virtual contact as there will be no language barrier. Lastly, AI is about developing 'smart' solution in the

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communication processes and systems. However, while it seems to be taking the centre stage, data / privacy bridge, hallucination, copyright, 'deep-fakes' or unethical use of information data are growing areas of concern in the AI evolution and digital communication. On this account, the UNESCO released a template on the ethical use of AI. It is a guiding principle that is expected to be adhered to by developers and users of AI technologies. This is to curb substandard AI products/ contents, promote freedom of speech and accessibility to information for a sane AI community (UNESCO, 2022).

4. Documentation and AI-Powered Visual Communication Design

All over the world, linguists engage in language documentation activities to preserve the linguistic and cultural heritage of the community. This is also applicable to the visual linguists/ designers who use photography, videography, illustrations etc. to make visual records for reference point. In the case of records or documentations meant for the deaf, visuals are best used, this underscores the importance of communication design. The elements or visual items needed e.g. texts, graphic images, videos, photos etc. are also information data and *"AI is only as good as the data you have…".* This is the remark of Suxena as captured by Leesa-Nguansuk in 2023. AI that rely on information data could be, in nature, predictive or generative e.g. ChatGPT. Technically, machine learning is also an example of AI, which means configuring a machine to learn, decide, improve and produce results. *"This can be in the supervised form (i.e. AI system is instructed and trained with dataset) or unsupervised form (AI system is not trained nor instructed but learns from data fed into it)"* (Afolabi, Oladesu, Siyanbola, Adeloye & Odewole, 2024). Interestingly, the models: 'supervised' and 'unsupervised' can be used to develop AI (for documentation) that would either be 'predictive' or 'generative'; it is only the approach to the end result that differs. Documentation in this regard or as it pertains to this study, is evidently the act of creating detail visual information about the sign languages. Visual communication design also comes in handy for the execution of such assignment. Relevant programs to get the job done are not the 'usual' Adobe suite or

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Coreldraw bundle; while they are industry standard programs, they must be in the upgraded form like Firefly or via plugin e.g. Vision FX. There are news programs with AI embedded features, making them highly suitable for completing the task. AI-powered visual communication design programs simplify visual design tasks. They have accuracy hence, will make the process towards documentation to be seamless, while the result will be perfect. The process include creative inputs like photo editing, fine-tuning, optimisation, text/ image sorting etc. meant to make the visual elements or their combination fit for achieving the sign language documentation. Other fitting programs are: Microsoft Designer, Canva, Midjourney, Visme, PromptHero, LunaPic, Dall-E, GIMP, Keyframer, HUGS and MGIE among others. The last three are proprietary programs by Apple. It is worthy of noting that relevant AI-powered visual design programs use cloud architecture; such as SaaS i.e. Software as a Service, hence warrants subscription. The key take away is that the programs simplify tasks and same time produce excellent professional piece which is germane in documenting visual sign language(s).

Visual communication design also includes crafting of interface, new media design and development such as mobile app or web to host the visual production and several other essentials, all of these are applicable towards a successful documentation project. The relevance of visual communication design in the documentation of sign languages cannot be over-emphasised. It is a core aspect of the project, since presentation and visualisation are involved. It requires sound knowledge in visual literacy, creativity and attention to details. Documentation with regard to Nigerian sign language and digital communication is more of multimedia that may not necessarily dwell on audio. The process will involve authoring a multimedia application leveraging AI. Prompt is a core component of generative AI, by implication text prompts will be integrated in the development process with a functional user interface; through the prompt, correct visual sign language would be displayed to users. The multimedia building blocks are the texts, graphic images, audio, pictures,

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video and animation; interactivity is involved at the advanced stage (Vaughan, 2011). Animated illustrations of the signs in 3D would make a better communication idea; while live video recordings can also be used in documentation purposes, they are always heavy and consume a lot of memory and storage space, which is a sort of disadvantage (Haibo, Shulin, Ashutosh, Mahmut, Anand, & Chita, 2019). Animated illustrations as alternatives are light in file size compared to recorded videos. Foundational process in the documentation project includes sorting out/ labelling all visuals that are equally information data for result accuracy. The compiled multimedia documentation, as a project on Nigerian sign language is finally to be hosted on a web server for easy accessibility. The best professional practice is to develop a mobile application, as a shell to easily access the multimedia files that are readily available on the server. Conclusively as a hint, integration of audio into the multimedia documentation will rather be for non-signers interested in learning visual sign language.

5. Established solutions in Documenting Nigerian Visual Sign Languages

Solutions put in place so far was the use of video technology in capturing the sign languages and compilation of deaf schools in Nigeria by the 'Save the Deaf and Endangered Languages Initiative' (S-DELI). They were all stored online with a clear intent of documenting solely the Nigerian indigenous sign languages (S-Deli, 2018). No other solution has been penned or developed towards the documentation of the sign languages that will also help in its official recognition. However, while the efforts of S-DELI are commendable, videos, technically consumes a lot of power, memory and storage space. Streaming recorded videos or downloading online video content will have effect on subscription data. This is because video consumes a lot of data especially if they are given high definition (HD) rendition, which is even the best practise. This is a factor that must be put into consideration especially as Nigerians are still battling with feeding, clothing, shelter and other essentials. Hence, subscribing to heavy loaded data for the sake of videos seems like

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additional burden at this period of economic meltdown. In essence, the documentation will still warrant an innovative process that will result into a documentation with precision like video; but will be more user-friendly, save cost, seamless with interactivity that is nonlinear in nature.

6. Theoretical Foundation

This study finds its support from the technological determinism theory and the development media theory. The former was formulated in 1960 by Thorstein Veblen, 1857 – 1929 (Smith, Marx, Roe & Leo, 1994). The main highlight of the theory is that the development in a society is directly proportional to her technology; which also drives social change. This is also affirmed by a report from World Bank in 2008 that *"technological progress and economic growth rates were linked, and that the rise in technological progress has helped improve the situations of many living in absolute poverty".* Thus, the role of technology is glaring and can even be traced to the earliest periods. It was used for creating products as a means of survival: knifes, bows and arrows for hunting, metal gong and slates for communicating etc. and currently, AI is trending. The process of acquiring technology is either through local invention/ fabrication or technological globalisation i.e. the cross-cultural development and exchange of technology across countries. Interestingly, while AI is a foreign technology, its adaptability to virtually all areas of human endeavours makes it unique; especially in healthcare, defense, education, transportation, media, language and communication etc. It is about seamless operations and saves time. AI has been used in language/ voice recognition such as witnessed in Alexa by Amazon, Apple's Siri, Bixby (by Samsung) and Google Assistant. Therefore achieving language documentation, including visual sign language via AI (an evolving technology), is also highly possible. This in return will re-shape the world of the deaf among the public and foster the official recognition of the language. Resultantly, this will also reposition the hearing impaired as an individual or a community that must be heard, not marginalised; rather cared for. From the foregoing, technology such as AI empowers, through that, man lives a more productive and adaptable lifestyle:

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socially, economically, creatively etc. - more reason for this theory which its hallmark is about development.

The development media theory was propounded by McQuail in 1987 (Oluwasola, 2020). Aside the fact that the theory maintained that the media should be a source of support for the government, it also pointed out on the relevance of the media as a tool for growth, social change and development. Basically, the theory projects the media as a keystone for national and societal development. Apart from the conventional systems of communication, media is also exemplified in the new media and smart technologies – AI inclusive. They all form means of digital communication as they are equally products of technology for human benefits. Evidently, with the advent of the internet, the world has speedily become a global space for interactive communication while AI solidifies the process. This is a cogent reason to tap into AI so as to achieve the gains of advanced digitisation. This theory is relevant to this study at this period because Nigeria needs a media platform that will help in achieving the development craved for (in communication) among the general public. For example, the hearing impaired that also forms a good number of the Nigerian population desired that their visual sign language be officially recognised. This will definitely create a sense of belonging for them in Nigeria and an accommodating environment. In a logical manner, language recognition is incomplete without formal documentation of the sign languages. Simultaneously, the media is essential if documentation is to take place; such that the process would be seamless and the results, innovative. Findings have shown that AI excels in these core areas for both communication, visual and audio-visual solutions. These are attributes of the development portrayed by the development media theory. Therefore, technical solution to a social challenge, such as lack of documentation of visual sign language can be resolved through the media that draws its strength from a productive technology - AI. As a cautionary note, AI is expected to be used in the documentation process in a manner that users can always fall back on the sign languages documented as a reference point. For clarity, after the

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compilation of the visual sign languages, it should equally yield a mobile program for accessing the languages but users' of mobile applications/ programs desire flexible engagement. Thus, AI should also be used to achieve quality interactivity in digital communication; it is then the media is serving a developmental purpose.

7. Methodology

The study is based on library research method, thus makes it a qualitative study; with reliance on secondary data gotten from: journal articles, internet resources, electronic and print archives to mention but few. Other relevant secondary materials were consulted for explication in this expose. The secondary approach provided the essential scholarly works that were assessed before the discourse took its position. However, Townsend (2013) summed up that qualitative study survives on the richness of the data collected. This was duly considered during the process of conducting this research on visual sign languages in Nigeria, which is significant not only to the hearing impaired but also the non-deaf people. Opinionatedly, when the visual sign languages are duly documented with an innovative but flexible technical process, it will also facilitate the recognition of the (sign) language in Nigeria. Non-signers can also learn easily while it amounts to communication for development.

8. Findings cum decisive opinion anchored to the theories

It would be wise to decide a way forward amid the issues identified and the solutions thus far. The point here, being a precise foundation, is to be able to give room for reasonable suggestions. Hence, based on findings from established facts, it is reasonable to state that the documentation of Nigerian visual sign languages would yield innovative results if AI is adopted in the technical production process. Apart from that, documentation with AI revolves more around technical operations than non-technical engagements. AI is the act of making the computer or a program to think and act like a man, thereby performs what ordinarily only humans can do. This is very profitable in the era of digital communication as a program or AI can be trained on the indigenous

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Nigerian sign languages; with as many variants as possible. This would definitely ease the burden from human deaf trainers which at some point could be strenuous demonstrating all the several visual sign languages available in Nigeria for video recording. Live or recorded videos are equally known to be heavy in file size which has its pros and cons. Nigeria as a nation boasts of about approximately 24% of deaf population (Treat, 2016) with different visual sign languages that are confirmed to be indigenous (Asonye & Edward, 2022). Regrettably, findings showed that only 4 African countries have officially registered their sign language(s), Nigeria is not even on the radar. Therefore, incorporating AI into a multimedia production of the Nigerian sign language will make documentation of many variants of the indigenous visual sign languages to be possible. The several recordings of gestures reflecting the syntaxes, vocabularies and even making the actions among others, may be demanding or strenuous for humans but that is not the case with AI. Reason being that when AI is involved, humans will rather supervise while the AI-enabled programs will be generating the actions. This is possible since AI uses existing data to make predictions or create needed actions; such AI system according to Kimega (2024) *"is capable of learning from mistakes to increase their accuracy"* and would perform in few seconds what ordinarily would take weeks to be accomplished by many people. Visual sign languages can be developed based on supervised machine learning called Artificial Neural Network (ANN); and coupled with visual communication design like animation and 3D illustrations etc., this will innovatively result into a mobile application. Graphic images as information data from the indigenous sign languages will be appropriately labelled and used to train a model that would be involved. This model will then be used to categorise the image samples of various gestures and movements or words as they pertain to the indigenous Nigerian sign languages. Resultantly, the model based on the action(s) generated by the 3D mobile application and importantly with a well labelled training data, will provide an output of what the sign means in a real human settings. This approach is adaptable for the

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documentation of any visual sign language in Nigeria. Thus, whatever the variants, AI simplifies the task, weaving many indigenous sign languages and non-indigenous ones into one system. Concurrently, it has also been discovered that in practise, AI can be used ethically free from biases and 'deepfakes' from wrong information data. This will definitely enrich production result.

These decisive views keyed into the belief of technological determinism theory which clarifies that the development of a society is shaped by the technology it adopts. Likewise, the media is a key player in the development of a nation and the society; that is the point of the development media theory. AI embedded in communication, has not removed the fact that it is a form of new media, rather this will strengthened communication which is basically solution towards societal development. Documentation of Nigerian visual sign languages with the use of AI reflects technological advancement in the current trend. This will position Nigeria as a nation in a good stand and not backward innovatively. The end product of AI-powered documentation is a program (mobile app) rich in interactivity through text prompts. Surely, it is beneficial to the hearing impaired and non-deaf people such as in education and reference point on how to communicate properly with the aid of the visual signs. Simplicity in the technical process of documentation, together with a robust result e.g. the possibilities of having many sign languages documented and accessed, equally makes this technology a desired innovation. The adoption of AI will definitely sharpen communication and information technology practises for professionalism in Nigeria (Afolabi, Oladesu, Siyanbola, Adeloye & Odewole, 2024). Summarily, from all indications, AI will play a crucial role in securing digital communication channels in the future (Edenilson De Meira, 2023). By leveraging AI to document visual sign language, communication/ learning (through an AI-powered program or mobile app, also an example of a media) can become more user-friendly, personalised and efficient. This, as a factor has the potentials to strongly influence the positive improvement of social-cultural engagement among

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the people in real life. The deaf in the society will then feel safe while discrimination is expected to reduce, because some people still see them as social misfits.

8.1 Simplifying the 'Model' in Machine Learning Linked to AI

Practically, the model, in the simplest form and in the context of this study refers to visualised images i.e. drawn figural characters of the hand gestures for the indigenous sign languages. This can be in 2-dimension or 3-dimensional forms, but 3D is a better option. The former (i.e. 2D) has no depth, simply flat diagrammatic piece (see fig. 1). The latter are characters' images and their forms, gestures etc. are real with the availability of depth in the figural shapes. The depth is achieved through colours and shadings. The visuals, correctly labelled and sorted in different categories, are information data needed to train the AI system on indigenous sign languages, thereby results as well into documentation. This can then be accessed on mobile applications by "prompting" i.e. the act of asking AI applications questions and getting response. It is all about engaging interactions and feedbacks while focusing on the indigenous Nigerian sign languages. Training of the AI system is done technically by the Machine Learning Engineer or Multimedia specialist (that is also skilled in data science), using supervised machine learning principles. This is after 3D images of the sign languages must have been captured/ visualised appropriately. Afterwards, the visual contents are available to users through mobile applications downloadable on relevant platforms: Apple, Google Playstore, Samsung Galaxy Store etc. The same final contents can also be stored on compact disc as multimedia CD, playable on the computer system. From the foregoing, this explanation on a model is perceived from the point of a multimedia specialist or a digital visual communicator. Note that, a Computer Scientist or an Engineer will rather see it (i.e. a model) as an algorithm, a sort of mathematical representation of a link between input data and output data.

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9. Conclusion and recommendations

"Technology seems to be a solution for communicating with the deaf and hard of hearing children and members of the Deaf community. One way to support the deaf and hard of hearing individuals is to provide assistive technology tools. These tools include technology that is geared toward education, communication, and improving the quality of life" (Adeoye, 2022 p.6). Ideally, creativity is critical in weighing all options that pertains to this assertion and the key point from the quote revolves around innovation. It will not be bad to come up with a multimedia product that will be dual or multi-purpose in nature. Such a product will aid communication, educate and same time document the visual sign languages in Nigeria. This is the essence of Artificial Intelligence (AI); especially at a time when communication is experiencing transition from the conventional to a digital format. AI is about information data to make predictions or generate actions; an act to make a system think or act like a man. Studies have proven that AI is accurate, fast and simplifies task (IBM Inc. 2020; Mamdouh, 2023; Ali Elfa & Dawood, 2023). This is a plus for human race and a good reason to adopt it in documenting Nigerian sign languages which is not officially recognised; despite that the deaf occupy a huge number of the Nigerian population. Solutions put in place so far was the use of video technology in compiling some sign languages and deaf schools in Nigeria in an online directory by S-DELI (Save the Deaf and Endangered Languages Initiative). However, while the effort is commendable, videos, technically has its merits and demerits. Therefore, amidst the call for collaborative inputs by S-DELI, the use of AI which is an advanced technology will complement existing efforts towards a robust visual sign language data base. It is also on this premise that this study springs forth and thus recommends that:

1. In resolving issue on who to document for the visual sign languages, AI is advised. AI being the primary strategy embedded in digital communication will help to achieve a program/ mobile application that can perform or demonstrate precisely (via a model) the sign languages. Thus, as a form of media, other meaningful and

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information contents should be integrated for educative interactions; this will also breed development and sustainability**.**

2. When the visual sign languages are documented in Nigeria, it will definitively cater for the argument on reason for documentation. This is not only about having records, but adopting AI will also create innovative technological development for social engagement. This relational lifestyle which is key in Nigeria and African culture will be promoted among the hearing impaired and those that are not deaf but prefer to learn the language.

3. AI is encouraged in full force so as to tap into its merits while experts in ICT (i.e. Information and Communication Technology) such as Prompt Engineers, Communication designers, Media technologists and Content creators should be employed or team up in the documentation of the visual sign languages in Nigeria.

4. Ethical considerations on AI as specified by United Nations Educational, Scientific and Cultural Organisation (UNESCO) should be at the forefront in the use of this trending technology in Nigeria. This is also crucial in the documentation of visual sign languages so as to meet international standards.

5. Genuine information data (in abundance) that is free of biases is advised to be used in training the AI model for visual sign documentation. This will certainly address AI flaw such as hallucination – 'the delivering of incorrect and misleading results by the model' (Google Cloud, 2023).

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